Users' Manual

COBHAM

Robust Links SOLO4 User Manual

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2 Change History

Version	Main Changes from Previous Version	Edited By
v1.0	Initial Release	MP
V1.1	Minor revision for technical accuracy	NMcS
V1.2	Updated for correct Part numbers	MP
V1.3	Added UHF Part numbers	NMcS
V1.4	Modified UHF RX frequency range	NMcS

3 About this Manual

This manual describes the operation of domo Robust SOLO4 digital wireless systems. The manual is divided into three main sections.

- **Getting started and basic operation**

  This section describes to users how to deploy and use a domo Robust SOLO system.

- **Advanced operation**

  This section describes the operation of the system in more detail, concentrating particularly on how to store and recall configurations, with use of the PC Controller Application.

- **Technical reference**

  This section provides technical specification and control protocol data and will be of interest to those integrating the Robust SOLO4 system into larger systems.

4 Introduction

The domo robust SOLO4 product range enables the user to build wireless digital microwave video systems. The domo Robust SOLO4 products have been designed to provide rugged point-to-point links for high quality full frame rate video, and audio, even in non line of sight and urban environments.

Existing analogue systems suffer from impairments such as video noise, loss of colour information and poor image quality when line of sight cannot be maintained, and solutions based on wireless internet standards and PC platforms deliver poor quality video.

The domo robust SOLO4 system is a digital system that uses the COFDM modulation technique, which effectively eliminates the problems caused by multipath and reflections.

The Robust SOLO product range allows law enforcement, surveillance and emergency service communities to now receive the highest quality video images, in real time, direct from personnel, buildings and vehicles.

The domo Robust SOLO4 system employs two transmission systems. The DVB-T 2K carrier COFDM technology is used as it provides an interoperable means of transmission. However, the **domo** Robust SOLO4 system also employs a revolutionary narrow band 2.5MHz COFDM technology which demonstrates better propagation for longer range links, and extra bandwidth efficiency. The **domo** Robust SOLO4 system can also be upgraded to include a 1.2MHz COFDM modulation and MPEG4 compression for excellent range performance.

- The robust SOLO4 transmitter is a military style, low-power transmitter suitable for harsh environments, body-worn applications where size, weight and power consumption are at a premium.
- For longer range applications such as vehicle transmissions, the robust SOLO4 transmitter can be upgraded with the use of a robust booster amplifier.
- The robust SOLO4 receivers are diversity input receivers with extensive built in spectrum analysis tools. The receivers can be fitted with an optional **NETSTREAM** card, which then gives the option of streaming the received video onwards over IP networks.

IMPORTANT NOTE

The robust SOLO4 product range has been specifically designed for government security and law enforcement users, the equipment will tune across frequencies that are only available to licensed government users. Non-government users should employ the equipment restricted to the license exempt bands only typically 1.389 to 1.399GHz.

5 Warranty and Support

5.1 Warranty Cover

domo offers a 12 month standard product warranty. During this period, should the customer encounter a fault with the equipment we recommend the following course of action:

- Check the support section of the website for information on that product and any software/firmware upgrades. If fault persists;
- Call our support line and report the fault. If fault persists and you are informed to return the product please obtain an RMA number from the domo support department, and ship the equipment with the RMA number displayed and a description of the fault. Please email the support section the airway bill/consignment number for tracking purposes.
- If you have extended warranty provisions then domo will send an immediate advance replacement to you. Under most circumstances this must be returned once the fault item is repaired.

Depending on the nature of the fault domo endeavor to repair the equipment and return it to the customer within 14 days of the item arriving at our workshops.

Obviously it is impossible to cater for all types of faults and to manage 100% replacement part availability, and delays are sometimes inevitable. This is why domo recommend that its customers take out an extended warranty (which includes advanced replacement of faulty items), and/or hold a basic level of spare parts, which can be held by domo on the customer's behalf.

Please contact domo for details of packages that can be tailored to meet your individual needs, whether they are service availability, technical training, local geographic support or dedicated spares holdings.

6 Safety, Compliance and Approvals

6.1 Safe Operating Procedures

- Ensure that the power supply arrangements are adequate to meet the stated requirements of each robust SOLO4 product.
- Operate within the environmental limits specified for the product.
- Do not subject the indoor equipment to splashing or dripping liquids.
- Only authorized, trained personnel should open the product. There are no functions that required the User to gain access to the interior of the product.

6.2 EMC / Safety and Radio Approvals

The equipment has been designed to meet and has been tested against the following harmonized EMC and safety standards:

- EN 301 489-1 & EN 301 489-5
- EN 61000-3-2:2000
- EN 61000-3-3:1995
- EN 55022:1998, Class B
- EN 61000-4-2:1995
- EN 61000-4-3:1996
- EN 61000-4-4:1995
- EN 61000-4-5:1995
- EN 61000-4-6:1996
- EN 61000-4-11:1994
- EN 60950:2000

The license exempt equipment (SOL2TX-138139, SOL2TX-240248, SOL4TX-138139 and SOL4TX-240248) meets the following radio approvals.

1 EN 302 064-1

1.3 CE marking

The CE mark is affixed to all SOLO4 products except robust links, and the CE Declaration of Conformity, as well as the technical file, is available on request.

2 Getting Started and Basic Operation

2.1 Which Model do I have?

Each unit in the domo robust SOLO4 product range is marked with a serial number in numerical & barcode format.

- Serial Number Panel.

5W Amplifiers are provided with serial number panel:

The domo product code can be referenced in the table below.

Product Code	Product	Accompanying items
11204-01-03 (1.15 to 1.4GHz) 11204-01-13 (2.28 to 2.55 GHz) 11204-01-23 (3.1 to 3.4GHz) 11204-01-33 (340 to 470MHz)	100mW DVB-T and Narrow Band Digital Video SOLO4 transmitter	Cables: CA0220 = DC Power 1m CA0222 = Control/Data 1m CA0224 = Audio 1m CA0225 = Video 1m CD with operating software and manual
11302-01-03 (1.15 to 1.4GHz) 11302-01-13 (2.28 to 2.55 GHz) 11302-01-23 (3.1 to 3.4 GHz)	2-way diversity SOLO4 Receiver (Inc IP Output)	Cables: CA0219 = Power 2m CA0221 = Video/Audio 2m CA0222 = Control/Data 1m CA0223 = IP 2m CD with operating software and manual.
11302-01-01 (1.15 to 1.4GHz) 11302-01-11 (2.28 to 2.55 GHz) 11302-01-21 (3.1 to 3.4 GHz) 11302-01-34 (050 to 850MHz)	2-way diversity SOLO4 Receiver	Cables: CA0219 = Power 2m CA0221 = Video/Audio 2m CA0222 = Control/Data 1m CD with operating software and manual.
11805-01-03 (1.2 to 2.5 GHz) 11805-01-23 (3.1 to 3.4 GHz)	1W Amplifier	Cables: CA0220 = DC Power 2m CA0226 = Antenna cable 0.15m CA0227 = Amplifier RF cable 0.15m

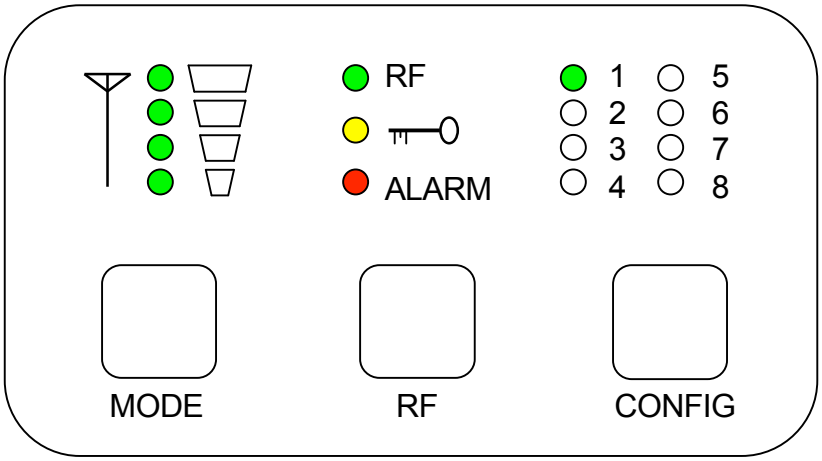
L1-5 (1.15 to 1.4 GHz) S1-5 (2.25 to 2.55 GHz) C1-10 (3.1 to 3.4 GHz)	5W Amplifier	Cables: CA0228 = Amplifier RF cable 0.15m CA0226 = Antenna cable 0.15m CA0229 = DC Power 1m

Note: Receivers are made frequency specific by the inclusion of appropriate down converters within the enclosure housing.

Controls

Transmitter Control Panels:

Robust SOLO4 transmitters are equipped with a standard LED (Light Emitting Diode) and push button panel. The panel is as depicted below, and the buttons and LEDs have meanings as explained in the table.

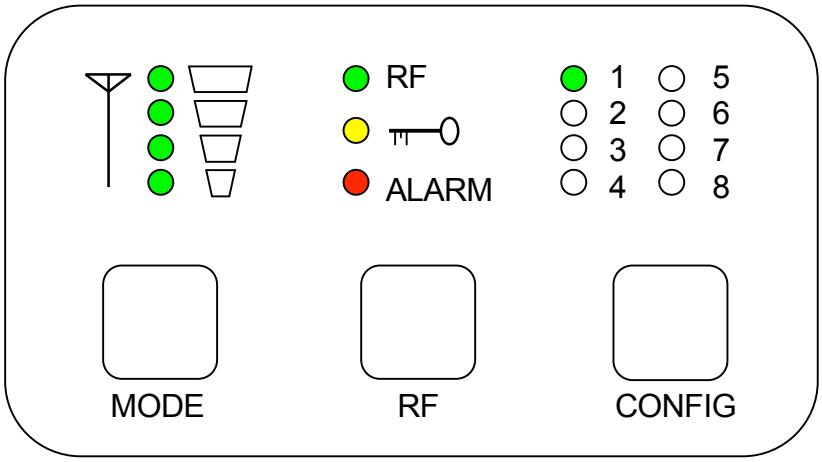


LED / Button	Colour	Meaning / Use
Alarm LED	Red	When lit indicates alarm or fault condition on equipment. Usually means no lock to incoming video.
Front Panel Lock LED	Yellow	When lit indicates the stream is encrypted (v 3 software and above)
RF LED	Green	Transmitter: When lit indicates RF output is active.
LED 1 to 8	Green	Indicates which of the 8 stored configurations is currently selected.
Range Mode LEDs	Green	SOLO4 Transmitter: Indicates range mode Ultra Long Range: 1.25MHz QPSK FEC1/3 (optional) Long Range: 2.5MHz QPSK FEC1/3 Medium Range: 2.5MHz QPSK FEC2/3 Short Range: 2.5MHz 16QAM FEC2/3
RF Button	-	Transmitter: Pressing the RF button toggles the units RF output between OFF and ON. Holding down button toggles unit into standby mode.
Config Button	-	The config button when pressed selects the next configuration from memory. Holding down button toggles front panel lock.
Mode Button	-	SOLO4 Transmitter – Toggles between the range modes previously described.

Receiver Control Panels:

SOLO4 Robust Receivers are fitted with an LED (Light Emitting Diode) and push button panel.

Receiver Panel Style 1, Fitted on Box Style 1.



Receiver LED and Button Meaning

LED / Button	Colour	Meaning / Use
Alarm LED	Red	When lit indicates alarm or fault condition on equipment. Usually means no lock to incoming RF, or encrypted video that can not be de-encrypted.
Front Panel Lock LED	Yellow	When lit indicates the stream is encrypted.
RF LED	Green	Indicates RF lock when ON.
LED 1 to 8	Green	Indicates which of the eight stored configurations is currently selected.
Range Mode LEDs	Green	Indicates approximate signal strength level 1 LED On = low signal level 2 LED On = medium signal level 3 LED On = good signal level 4 LED On = very good signal level
RF Button	-	Pressing the RF button toggles the OSD (On Screen Display Function) of the receiver. Press Once = OSD On Channel A Press Again = OSD On Channel B Press Again = OFF
Config Button	-	The config button when pressed selects the next configuration from memory.
Mode Button	-	No Function

2.2 Getting Started with the Transmitter

Cables and Connections

This section describes how to connect the following domo model numbers.

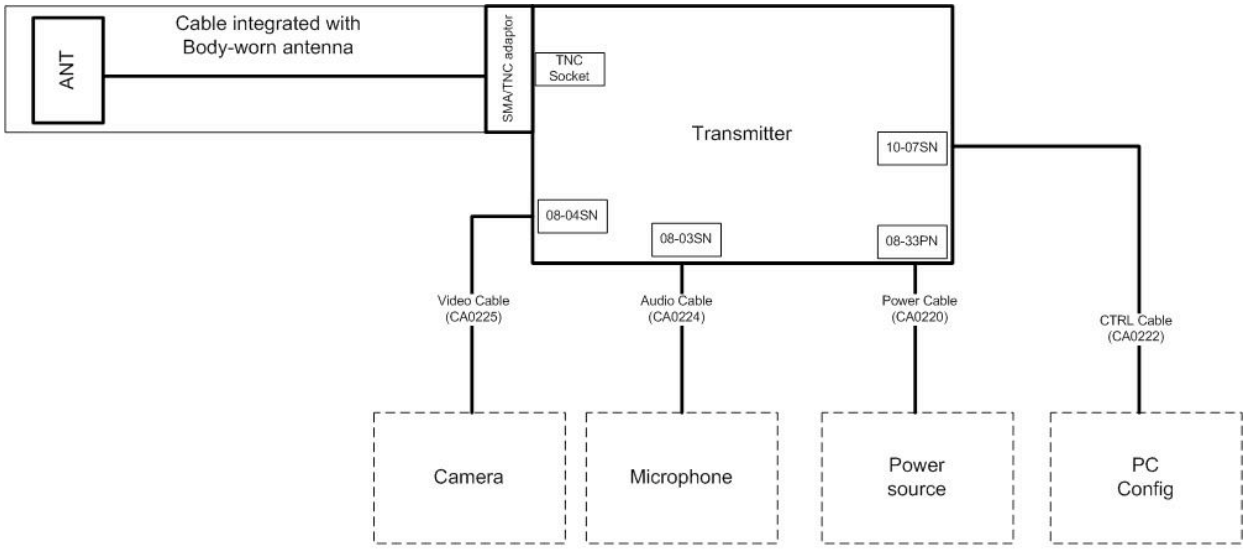
- M11204-01-03 (SOLO4 TX: 1.15 to 1.4GHz)
- M11204-01-13 (SOLO4 TX: 2.28 to 2.55GHz)
- M11204-01-23 (SOLO4 TX : 3.1 to 3.4GHz)

The picture below shows the domo robust SOLO4 transmitter with RF Button cover fitted.

The domo robust 100mW transmitter is supplied with the following cables.

Part No.	Cable Description	Length (m)
CA_0220	DC Power	2
CA_0222	Combined Control and Data	2
CA_0224	Audio Cable	2
CA_0225	Video Cable	2

The **domo** robust transmitter should be connected as shown below.



Note: dotted items not supplied.
SMA/TNC adaptor is fitted to antenna

Control & Data Cable – CA0222

The control & data cable is used for connecting the transmitter unit to a PC when using the domo PC control application. The PC control application is described in more detail the Advanced Operation section of this handbook.

The Control & Data Cable connects to the transmitter, two RS232 9-way “D” type connectors labeled “Data” and “Control.”

Video cable – CA0224

The video cable connects to the transmitter on connector labeled “Video- In” and the video source is connected to the BNC connector.

Connector	Signal
Video BNC	75 ohm composite video source, PAL or NTSC software selectable

Typically the video source will be a small colour or black and white CCD camera.

Audio cable – CA0225

The audio cable connects to the transmitter on connector labeled “Audio- In” and the audio source is connected to the phono plugs (white & red) connectors.

Connector	Signal
Audio Plugs	Line / Microphone level audio, switchable. Line level -2dBu clip level low impedance source (< 600 ohm) Microphone level 12, 24, 36 and 48dB preamp stages software switchable

Microphone power is provided on the audio connectors at approximately 3V (suitable for Electret microphones)

Typically the audio source will be an Electret microphone.

DC Power – CA0220

The transmitter unit can be powered from a nominal 12V DC supply or an AC to DC adapted supply.

Push the Amphenol connector on the DC power cable into the socket labeled “DC IN”, taking care to align the connectors. Connect the banana connectors on the other end of the cable to a suitable DC source.

The 12V DC input has the following characteristics.

- Input Voltage Range – 5.9V to 16V, reverse voltage protected.
- Current draw - 0.48 to 0.4A at 12V (mode dependant)

Antennas

domo robust transmitters are supplied as standard without antennas. An antenna must be connected for normal operation. The transmitter unit is supplied with a panel mounted TNC connector which carries the RF output. The antenna should be connected by screwing it onto the TNC, but care should be taken to not over tighten the connector.

The transmitter has the following RF output characteristics.

RF Spec	Model Number M11204-01-03	Model Number M11204-01-13	Model Number M11204-01-23
Output Frequency	1.15 to 1.40 GHz	2.28 to 2.55 GHz	3.1 to 3.4 GHz
Output Bandwidth	2.5 MHz	2.5 MHz	2.5 MHz
Output Power	100 mW (nominal)	100 mW (nominal)	100 mW (nominal)
Output Impedance	50 ohm	50 ohm	50 ohm

Note. It is recommended that the antennas be connected directly to the transmitter unit. The use of RF cables at this point will degrade the performance of the system.

The optimum choice of antenna will vary according to application. The following table gives some suggestions for suitable transmit antennas with the associated domo part number.

Application	Gain (dBi)	Frequency	Antenna model number
Mobile body worn application	3	1.15 to 1.26 GHz	ANTBCL1
	3	1.26 to 1.4 GHz	ANTBCL2
	3	2.3 to 2.5GHz	ANTBCS
	4	3.1 to 3.5 GHz	ANTBCSH
Mobile vehicle application	4.5	1 to 1.40 GHz	ANT4L
	4.5	2.3 to 2.55GHz	ANT4S
	4.5	3.1 to 3.35 GHz	ANT4SH
Long range point to point link	12	1 to 1.40 GHz	ANT12L
	12	2.28 to 2.55GHz	ANT12S
	12	3.1 to 3.5 GHz	ANT12SH

Note. When using antenna types ANTBC1L, ANTBCL2 & ANTBCSH with **domo** transmitters SMA to TNC adaptor connectors will be needed.

Other antennas for more specialist applications, such as aircraft use or covert surveillance and other frequencies use are available on request from domo.

Installation Notes

The domo transmitter has been designed specifically for body worn applications; however it is a general-purpose wireless video transmitter and can be used in many applications including the following.

- Body worn portable applications
- Vehicle based applications

This section gives guidelines for how to install the transmitter in the above applications.

Body Worn Applications

Body worn applications will either be covert or overt and this will dictate the style of antennas and mounting of cameras.

With all body worn systems the antenna should be selected to transmit power away from body and domo recommends the use of the domo body worn antenna (part numbers **ANTBCL1, ANTBCL2, ANTBCS** and **ANTBCSH**).

Experimentation has shown that unlike traditional analogue systems, front and rear antennas are not normally required. The nature of COFDM and its immunity to

reflections will ensure that the signal normally bounces back to the receive site even when the operators body is positioned between the transmit and receive antennas.

In covert applications, ultra slim patch antennas can be used. domo does not supply patch antennas directly, but can recommend manufacturers on request.

The SOLO4 transmitter has been successfully tested with a wide variety of standard and pinhole cameras. domo does not supply cameras, but can recommend suitable cameras and suppliers on request.

The domo transmitter will become warm to the touch after prolonged operation, and so insulation between the operators' body and the transmitter unit should be considered.

Vehicle Applications

Typically, in vehicle applications, a greater range is required than with body worn applications, therefore the use of additional power amplifiers must be considered.

domo offers a range of power amplifiers. Interconnection between the transmitter and any power amplifier should be kept as short as possible, but where this is not possible, special attention should be taken to use only low loss cables. An appropriate cable might be RG213C/U. It is essential to minimise the distance between the amplifier and the antenna.

Mounting of the transmitter should use the mounting holes provided.

The transmitter is equipped with a self-regulating 5.9 to 16V input that can be connected directly to the vehicle battery. Power conversion will be required for 24V vehicles.

The video input can be connected across long video cable lengths so remotely mounted cameras should pose no problem.

The robust transmitter is splash resistant and waterproof. The transmitter is self-cooling; however it should be mounted in a ventilated environment. Forced air cooling is not required.

Note that although the robust transmitter has a 6V to 16V DC input the domo 1W amplifier is a 12V DC input device and must not be operated below 11V or above 15V.

2.3 Getting Started with the SOLO Receiver

Connections

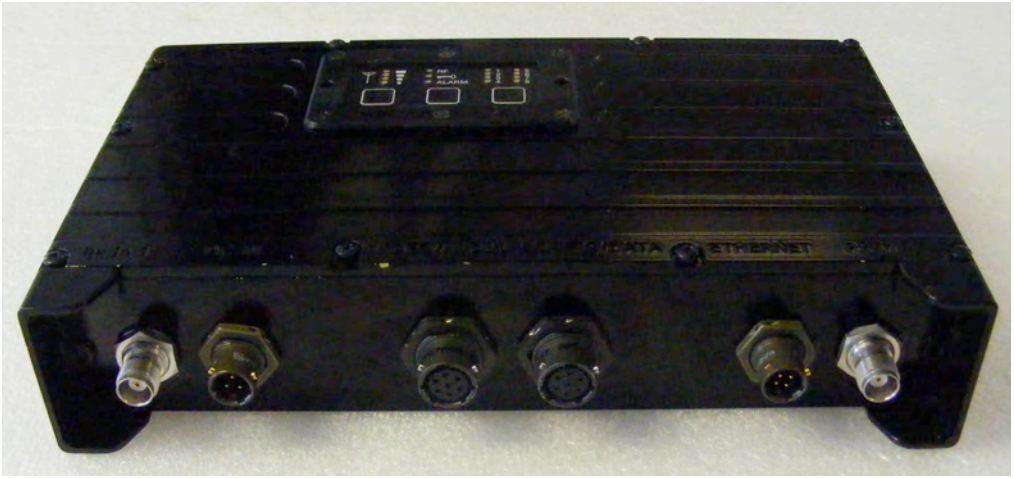
This section describes how to connect the following domo model numbers.

- 11302-01-03 (SOLO4 RX:1.15 to 1.4GHz, with IP streaming)
- 11302-01-13 (SOLO4 RX: 2.28 to 2.55GHz with IP streaming)
- 11302-01-23 (SOLO4 RX: 3.1 to 3.4 GHz with IP streaming)

The following domo model numbers are without IP streaming.

- 11302-01-03 (SOLO4 RX:1.15 to 1.4GHz, without IP streaming)
- 11302-01-13 (SOLO4 RX: 2.28 to 2.55GHz without IP streaming)
- 11302-01-23 (SOLO4 RX: 3.1 to 3.4 GHz without IP streaming)

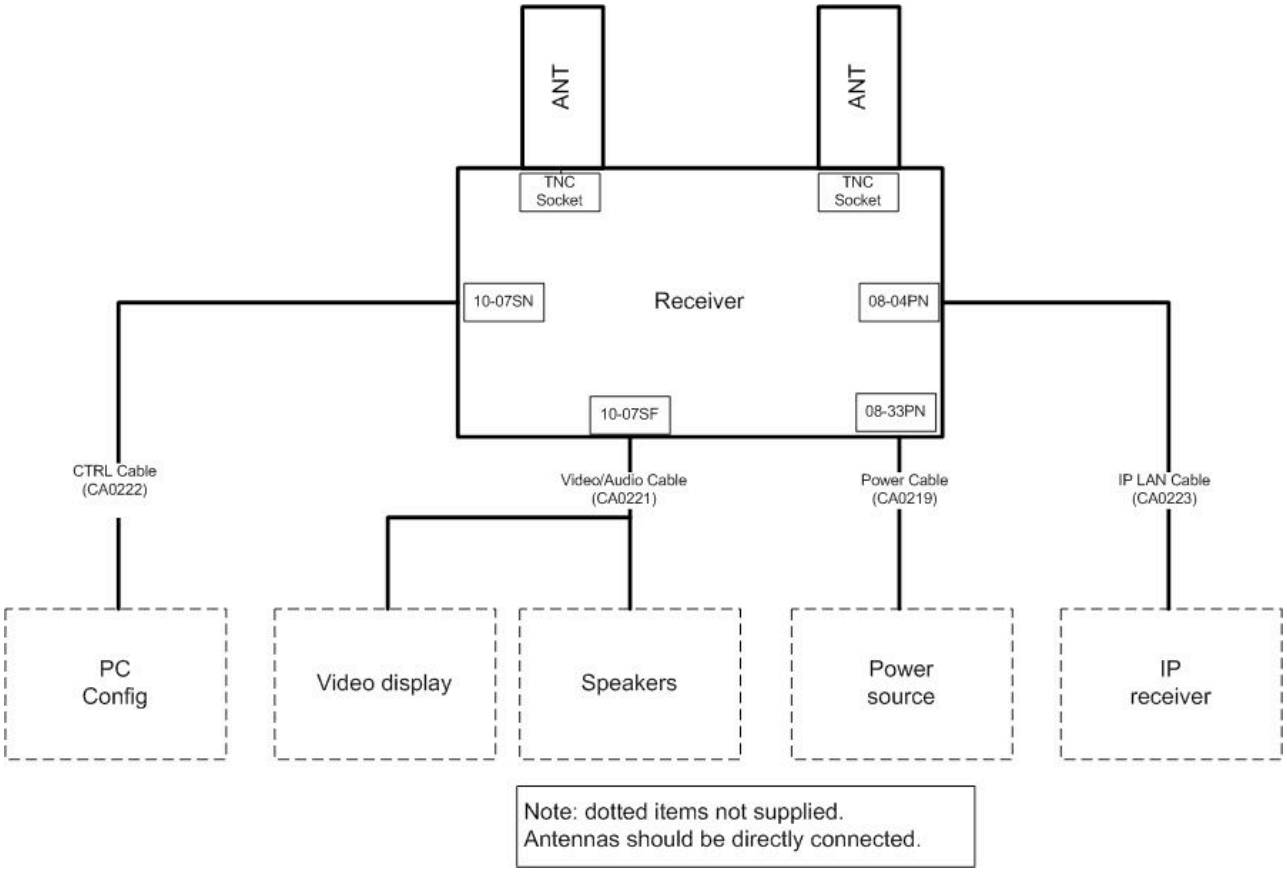
The picture below shows the **domo** robust SOLO4 transmitter.

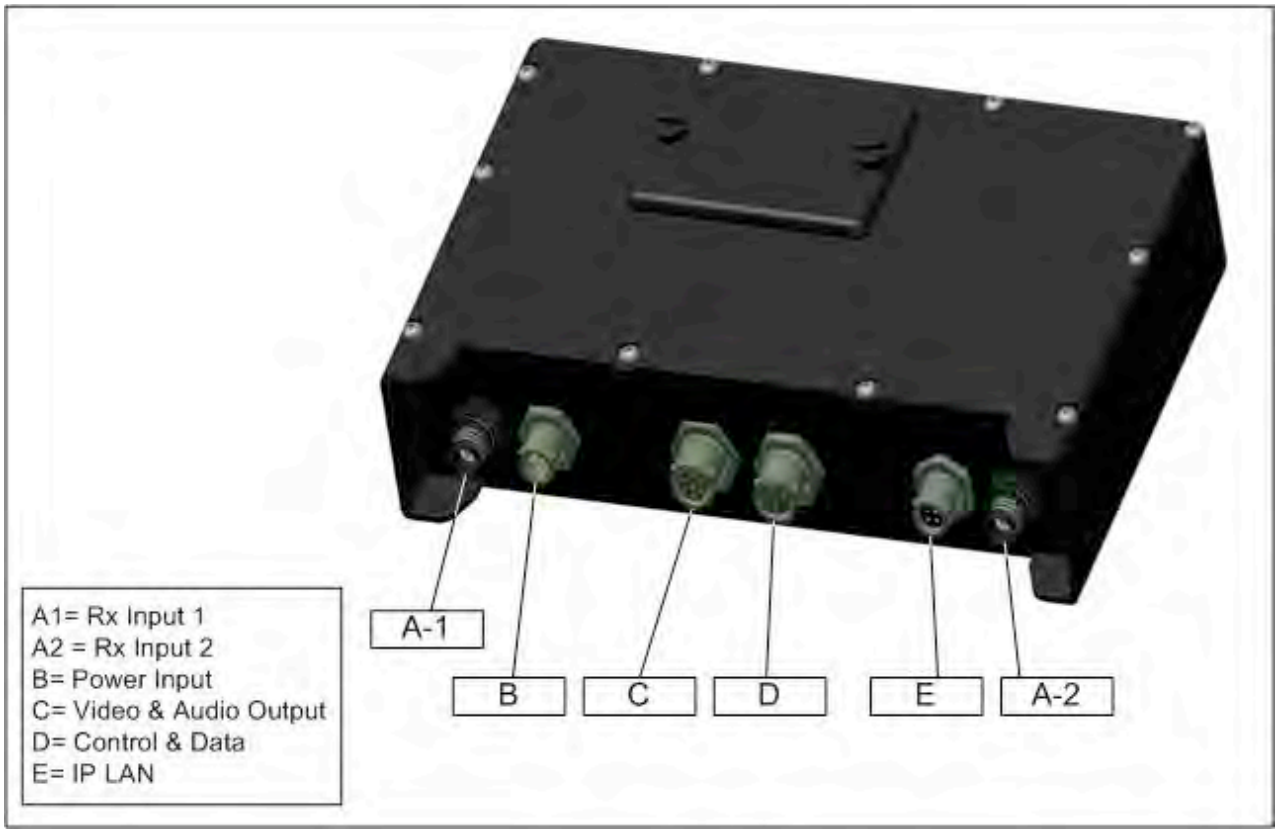


The domo robust receiver is supplied with the following cables.

Part No.	Cable Description	Length (m)
CA_0219	DC Power	2
CA_0221	Video / Audio Cable	2
CA_0222	Combined Control and Data	2
CA_0223	IP Cable	2

The domo robust receiver should be connected as shown below.


ANT
ANT
TNC Socket
TNC Socket
10-07SN
Receiver
08-04PN
10-07SF
08-33PN
CTRL Cable (CA0222)
Video/Audio Cable (CA0221)
Power Cable (CA0219)
IP LAN Cable (CA0223)
PC Config
Video display
Speakers
Power source
IP receiver
Note: dotted items not supplied.
Antennas should be directly connected.


A1= Rx Input 1
A2 = Rx Input 2
B= Power Input
C= Video & Audio Output
D= Control & Data
E= IP LAN
A-1
B
C
D
E
A-2

Diversity, Antenna Positioning and Use of Down Converters

Note: Domo down converters can be damaged by static electricity discharge when connecting antennas. It is suggested that only antennas with built in DC path to ground are employed to avoid static damage. If this can not be achieved then antennas should be shorted to ground before connection to the down converter.

The domo robust SOLO4 receiver is a diversity receiver and will give optimum results only when two antennas are deployed. Typically antennas will be positioned outside, usually on the roof of a building or a vehicle. The domo robust SOLO4 receiver includes the down-converters within the same enclosure as the receiver.

The domo robust SOLO4 receiver uses an advanced diversity technique called maximum ratio combining to construct a good spectrum from two potentially damaged received signals. To get the best results from diversity, the antennas should be physically separated by at least 100cm.

Sometimes better results can be achieved by separating the antennas further, or by positioning them of different corners of a building. The optimum antenna placement depends on the environment in which the equipment is used and the signal path, and is often limited by physical factors (accessibility for example).

Note: The length of cable between the antennas and the receiver is crucial to the performance of the system. Ideally the antenna would be mounted directly onto the receiver antenna connectors. If a cable is used then it must be of ultra low loss. Any cable loss of greater than 1dB will significantly decrease the system range.

The domo robust SOLO4 receiver is supplied without antennas since the optimum choice of antenna will depend on the operational scenario. For short range or mobile applications, omni directional antennas such as **ANTBCL1, ANTBCSH, ANT4L, ANT4SH** will be most suitable whereas for longer range fixed links, or where mobile transmit activity is happening in a defined 120 degree arc the higher gain **ANT12L, ANT12S** or **ANT12SH** will be more suitable.

Antennas should be screwed directly to the TNC input of the receiver to maximise RF range performance.

Video Output Connection

Connect the video output lead to the BNC connector labelled ‘VIDEO’ on the SOLO receiver and to the chosen video display device.

Connector	Signal
Video BNC	75 ohm composite video output, PAL or NTSC software selectable at the transmitter

Typically the video display device will be a high quality monitor.

Audio Connection

Push the LEMO connector into the socket labelled ‘AUDIO’, taking care to align the connectors and connect the chosen audio output device.

Connector	Signal
Audio Plugs	Line level, +7dBu clip level, low impedance source (20 ohm)

Typically the audio output device will be monitoring speakers.

DC Power

The SOLO2/SOLO4 Receiver is powered from a nominal 12V DC supply.

As standard domo supply a DC power cable terminated in positive and ground connectors. Push the Amphenol plug into the socket labelled ‘Power’, taking care to align the connectors. Connect the positive and negative connectors to your local DC supply.

The 12V DC input has the following characteristics.

- Input Voltage Range – 10V to 18V, reverse voltage protected.
- Current Draw – 1.4A at 12V

Control Cable

The control cable is used for connecting the SOLO receiver to a PC when using the domo PC control application. The PC control application is described in more detail the Advanced Operation section of this handbook.

Data Connection

The SOLO receiver features a general purpose CONTROL/DATA port used for outputting RS232 data transmitted from a SOLO2/4 transmitter.

Installation Notes

The domo robust SOLO receiver has been designed so that the antennas are mounted directly or remotely via the low loss and short RF cable.

The antenna itself should be separately secured, the TNC connectors should not be expected to take the strain of the antenna.

The domo robust SOLO4 receiver is designed to be waterproof.

The receiver is self-cooling; however it should be mounted in a ventilated environment. Forced air cooling is not required. Adequate clearance on either side the receiver (5cm) should be allowed for ventilation.

The receiver is supplied with a mounting plate that allows the unit to be screwed or strapped to a flat surface.

2.4 Powering on the System

All external connection to the robust SOLO4 products should be made, as described in the previous sections, before proceeding to power on the system.

Applying power to the Solo Receiver

On powering the robust SOLO4 receiver, one of the eight green configuration LEDs on the control panel will light (which one depends on which configuration was active when the receiver was switched off). The red Alarm LED may light if the receiver is unable to lock to a signal.

Applying power to the transmitter

When powering the transmitter directly from a 12V source, or from a connected battery, the following will be observed.

If none of the LEDs on the control panel light then the transmitter may be in standby mode. If this is the case then press, and hold the RF button for more than one second.

One of the eight green configuration LEDs on the control panel will light (which one depends on which configuration was active when the receiver was switched off).

The alarm LED may be lit, typically if there is no active video source.

Switch On RF on the transmitter

On the transmitter unit control panel, press the RF button briefly until the RF LED lights. This indicates that the RF output is active, and that the unit is transmitting.

If the receiver is able to receive the transmitted signal, the receiver RF LED will light indicating receiver lock, and the receiver ALARM LED should go out.

Video and audio signals will be presented automatically at the receiver outputs.

Changing Configuration

domo robust SOLO4 equipment features eight user selectable and programmable configurations. By default, all 8 configurations are set to the values which are listed in Section 10, Default Configurations. The configuration that is currently active is indicated by which of the eight configuration LEDs is lit on the control panel. Pressing the 'CONFIG button on the control panel of any domo SOLO equipment will select the next configuration in order.

On the SOLO transmitters, changing a configuration turns off the RF output to prevent accidental transmission and potential interference. The RF output must manually be re enabled once the user is confident that the correct configuration has been selected.

Modifying the default configurations is done from the PC control application, as described in the section on Advanced Operation.

Standby

Any of the robust SOLO4 transmitters can be placed in a low current consumption standby mode by pressing and holding the RF button for one second. The LEDs will go out indicating that the unit is in standby mode.

Pressing and holding the RF button for one second brings the unit back out of standby mode.

Diagnostic On Screen Display

The robust SOLO4 Receiver is equipped with a diagnostic on screen display. This facility will 'burn' diagnostic data onto the video output for test and set-up purposes. Pressing the RF button will enable this facility and a diagnostic screen will appear in the video as shown below.

The displayed diagnostic data includes a spectrum display, signal to noise data, input power level and frequency. The received spectrum display is useful when checking for interference signals, the SNR indicated signal quality. For more information on use of this facility a domo training course is recommended.

Using the OSD as a Set-up / Diagnostic Tool

The On Screen Display (OSD) is an extremely useful tool for system set-up and diagnostic.

When setting a domo system up the OSD should be used in the following way.

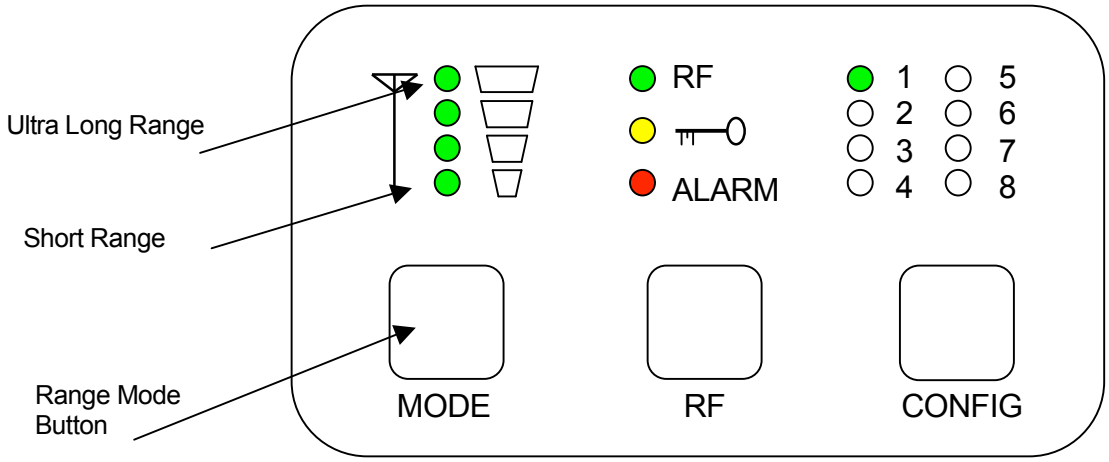
Check Channel is Clear

With the transmitter OFF, check that the channel is empty of interference signals, this is confirmed by ensuring that the reported power in the channel is at –99dBm and that the spectrum is shown as a rounded dome with no obvious spikes or tones.

Check Quality of Link

Switch on the transmitter and confirm that SNR is 6 or greater and that power level is at least –92dBm or greater. This represents approximately a 5dB margin. Failure of the link will occur when the power level reaches –97dBm or the SNR reaches 2dBm.

Using the transmitter Range Mode Button



The Range Mode button and LEDs on the robust SOLO4 transmitter, has the following function.

SOLO4 transmitter: Selects the range of the transmitter.

On a robust SOLO4 transmitter, the user can select various range characteristics, by repeatedly pressing the Range Mode Button, these can be toggled. The user should be aware that increasing the range will have the effect of reducing the image quality and increasing the video delay.

- Ultra Long Range: 1.25MHz QPSK FEC1/3 (optional) (Lowest Image Quality)
- Long Range: 2.5MHz QPSK FEC1/3
- Medium Range: 2.5MHz QPSK FEC2/3
- Short Range: 2.5MHz 16QAM FEC2/3 (Highest Image Quality)

2.5 1W robust Amplifier

Additional range can be achieved by connecting the 1W robust amplifier to the domo robust SOLO4 transmitter.

Connections

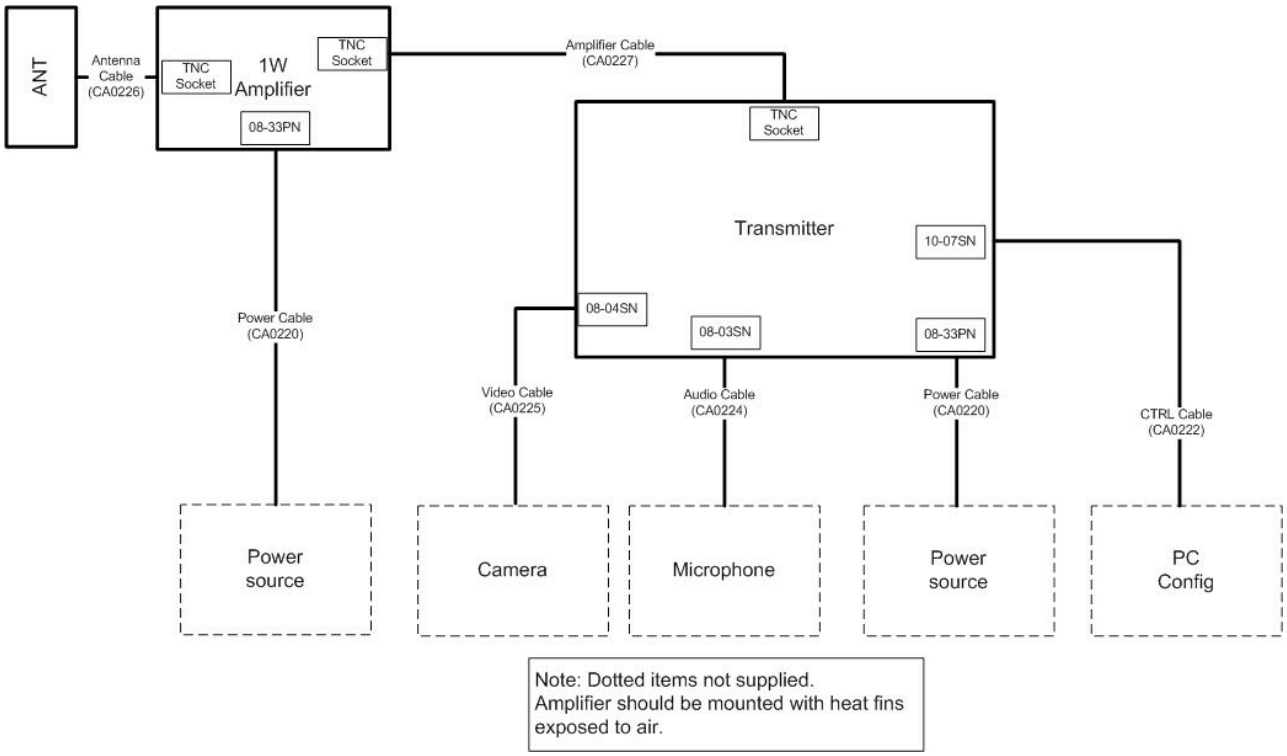
This section describes how to connect the following model numbers.

- 11805-01-03 (1W 1.2 to 2.5 GHz)
- 11805-01-23 (1W 3.1 to 3.4 GHz)

11805-01-03 can be mounted directly to the transmitter (11204-01-03). 11805-01-23 is a stand alone amplifier and is not designed to be mounted to transmitter (11204-01-23).

The domo robust 1W amplifier is supplied with the following cables:

Part No.	Cable Description	Length (m)
CA_0220	DC Power	2
CA_0226	Antenna cable	2
CA_0227	Amplifier RF cable	2



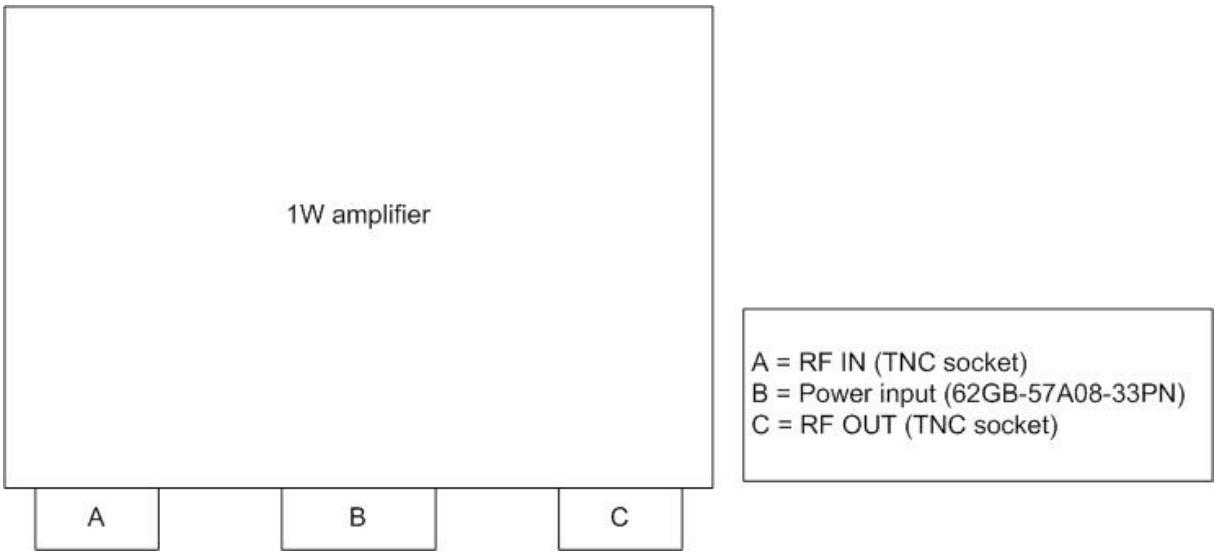
Amplifier Connection

The domo 1W robust amplifier (11805-01-03 [L-band]) is designed to mount directly onto the SOLO4 robust transmitter. The following steps should be taken.

1. Screw the robust SOLO4 transmitter down onto the robust 1W, using the 4 screws & mechanical plates provided.
2. Connect the RF output of the transmitter (TNC) to the RF input of the amplifier (TNC) using CA0227 cable provided. The 1W robust amplifier (11805-01-03) is designed to work directly with the robust SOLO4 transmitter (11204-01-03).
3. Connect an antenna to the amplifier via CA0226.

The 1W robust amplifier and transmitter assembled system is shown below.

The 1W robust amplifier Part No. 11805-01-23 is wider than the transmitter housing and consequently can not be mounted directly to the transmitter.



DC Power and Control Cable

The 1W robust amplifiers are powered by the CA0220 cable. However the voltage range when using the 1W amplifier is more limited.

- Input Voltage Range: 11-14.4V, reverse voltage protected.
- Current Draw 1.2A (typical) at 12V.

Antennas

domo 1W robust amplifier is supplied without antennas as standard. It is good practice to ensure that an antenna is always connected before powering the device. Prolonged operation without an antenna is not recommended. The antenna should be connected by screwing it to the TNC Type output connector with adapters as required, but care should be taken not to over-tighten.

Note: It is recommended that where possible antennas should be connected directly to the 1W robust amplifier. Use of cables will degrade performance.

Installation Notes

The domo robust 1W amplifier has been designed specifically for vehicle applications; however it is a general-purpose amplifier and can be used in many applications including the following.

- Vehicle applications
- Aircraft applications
- Long Range fixed links

Interconnection between the 1W robust amplifier, transmitter and the antenna, or any intermediate optional power amplifier should be kept as short as possible. Special attention should be taken to use only low loss cables. An appropriate cable might be RG213C/U. It is essential to minimise the distance between any amplifier and the antenna.

The robust 1W amplifier is equipped with a self-regulating 12V input that can be connected directly to the vehicle battery. Power conversion will be required for 24V vehicles or 28V aircraft systems.

The robust 1W amplifier is splash resistant and waterproof. The robust 1W amplifier is self-cooling; however it should be mounted in a ventilated environment with the heat sinks in a vertical position.

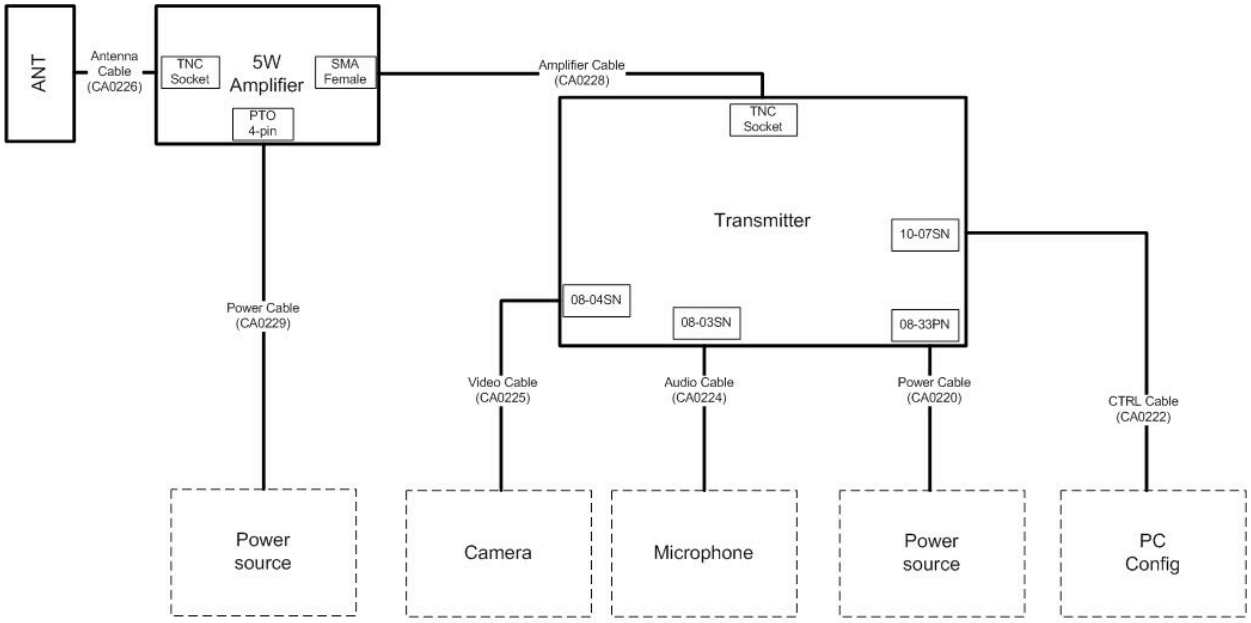
2.6 Using the booster 5W Amplifier

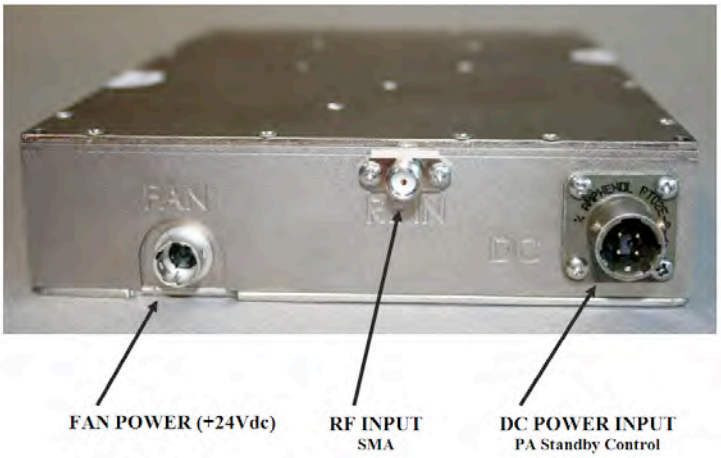
Additional range can be achieved by connecting the 5W amplifier to the domo robust SOLO4 transmitter as per diagram below.

This section describes how to connect the following model numbers.

- L1-5 (5W 1.45 to 1.4 GHz)
- C1-10 (5W 3.1 to 3.5 GHz)

Connections





The domo 5W amplifier is supplied with the following cables.

Part No.	Cable Description	Length (m)
CA_0226	Combined Control and Data	2
CA_0228	Audio Cable	2
CA_0229	DC Power	2

RF Connection

The domo AMP5W has the following input power requirements.

- L1-5 (5W 1.45 to 1.4 GHz): Input RF Power 100mW or 20dBm
- S1-5 (5W 2.25 to 2.55 GHz): Input RF Power 100mW or 20dBm
- C1-10 (5W 3.1 to 3.5 GHz): RF Input Power 100mW or 20dBm

Therefore care must be taken when connecting the 5W amplifier product to robust SOLO4 transmitter. The output power of the transmitter will need to be reduced when connecting to the 5W amplifier, this can be done using the built in digital attenuator using the PC Software GUI, or by fitting an RF attenuator in line. Damage will occur if RF power input to amplifier is greater than 23dBm.

Ideally when balancing the 5W Amplifier and domo transmitter a power meter should be employed, this will give best results, because cable losses can be factored.

5W Amplifier Standby Control

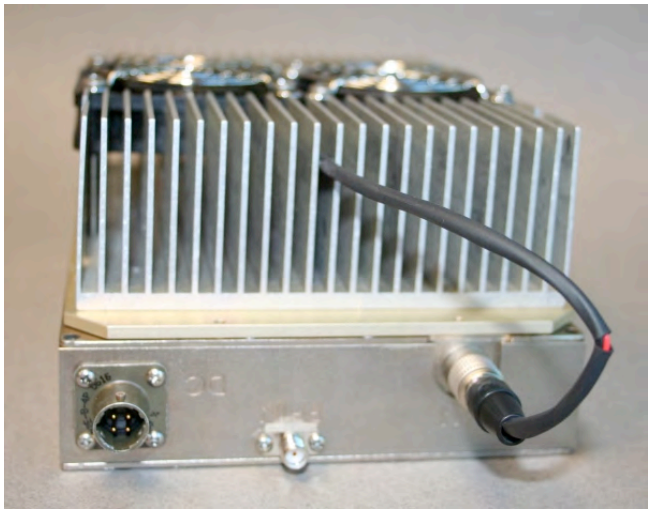
The RF signal from the 5W amplifier may be muted (switched off) by connecting Pin D of the chassis mount PTO 4-pin connector (J2) to ground. This feature puts the PA into standby to save current. No RF power is present at the output connector when the standby control is active (low).

5W Amplifier Forward Power Alarm

The 5W amplifier provides a forward power alarm on Pin B of the chassis mount PTO 4-pin connector (J2). This pin will have a digital high (+5 Vdc) when the PA is operating normally. If the RF power output should drop -6 dB from rated power, the pin will have a digital low (<2.5 V dc) as an alarm indication.

5W Heatsink Fan Assembly

The heatsink fan assembly attaches to the 5W amplifier and plugs into the FAN accessory connector on the input side of the amplifier. A regulated +24 Vdc is provided on the accessory connector with +24 Vdc on PIN 1 and ground on PIN 3. The heatsink fan assembly is shipped with a Hirose HR10A-7P-4S connector installed. The fans are thermostatically controlled and are activated when the temperature of the LPA Series amplifier rises above +44 ˚C. The L-Band amplifier may be supplied without the fans, as these are not required for safe operation.



5W Amplifier Specifications:

- Input / Output Protection – Open and Short Circuit
- VSWR – ≥ -10 dB Input and Output Return Loss
- Reverse Polarity Protection
- Short Circuit Protection
- Power-off standby
- Supply Voltage - +12 Vdc - +28Vdc
- Power Consumption – 50 W typical
- Operating temperature: -15 to +60 °C
- Non-Harmonic Spurious Output – > -65 dBc Typ.
- Nominal Drive - +20 dBm
- Overdrive Capability – Pin (nom) + 3 dBm
- Gain Flatness – ±0. 5 dB across operating band
- Operating Gain – 5W: (17 dB typ.)
- ACP – -30 dBc typ.
- Forward Power Alarm (TTL low = alarm)

If customers are concerned about balancing the input power when connecting 5W amplifiers, then they should contact domo directly.

5W Amplifier DC Power

Push the connector on the DC power cable into the socket labeled “DC”, taking care to align the connectors. Connect the banana connectors on the other end of the cable to a suitable DC source.

- Input Voltage Range – +12V to +28V dc, reverse voltage protected.
- Current Draw 3.8A (typ.) @ 12V dc.

5W Amplifier - Antennas

domo 5W Amp is supplied without antennas as standard. It is good practice to ensure that an antenna is always connected before powering the device. Prolonged operation without an antenna is not recommended. The antenna should be connected by screwing it to the TNC output connector with adapters as required, but care should be taken not to over-tighten.

Note: It Is recommended that where possible antennas should be connected directly to the 5W Amp. Use of cables will degrade performance.

5W Amplifier Installation Notes

Interconnection between the 5W amplifier transmitter and the antenna, or any intermediate optional power amplifier should be kept as short as possible. Special attention should be taken to use only low loss cables. An appropriate cable might be RG213C/U. It is essential to minimise the distance between any amplifier and the antenna.

The 5W AMP is equipped with a self-regulating 12V input that can be connected directly to the vehicle battery. Power conversion will be required for 24V vehicles or 28V aircraft systems.

The 5W AMP is NOT splash resistant, and is NOT waterproof, so it should not be exposed to moisture for prolonged periods. The 5W AMP is self-cooling; however it should be mounted in a ventilated environment. Forced air cooling is employed in some of the 5W AMP variants.

3 Advanced Operation

3.1 SOLO System PC Controller Application Software

Advanced control of the robust SOLO4 system is available by using PC control applications.

Typically users may want to customize the default configurations to control settings such as frequency, scrambling keys, modulation parameters, and video resolution.

- The robust SOLO4 transmitter products are controlled by the solo_tx_ctrl.exe application available on the CD delivered with the product.
- The robust SOLO4 receiver is controlled by the solo_rx_ctrl.exe application available on the CD delivered with the product.

Note that exact file names may change as software version information is a part of **domo** file names.

A PC is required with two RS232 Serial COM ports to control both a transmitter and receiver simultaneously. Where changes are to be made to either a transmitter, or a receiver, at different times, a PC with a single RS232 Serial COM part can be used.

Installation of the two control programs is as simple as copying them from the CD to a suitable location on the PC. No install shield routine is launched. Note that the controllers generate their own log and initialisation files, so it is best to create a dedicated directory for these applications, perhaps with links to the applications from the desktop of the PC.

Use the supplied cables to connect the chosen COM port(s) of the PC to unit(s) to be configured.

Launch each application in turn by double clicking or using the run command.

Connection with a SOLO product should be automatic, but the user can force selection of the correct COM port using the drop down, followed by the “Connect” button.

Errors such as the following may appear during the connection process if the PC is unable to automatically ascertain which unit is connected to which COM port.

- Error attempting to read invalid address
- Error has occurred during polling, polling has been disabled

For both controllers, changes can be made to the unit configuration using the drop down and data entry fields.

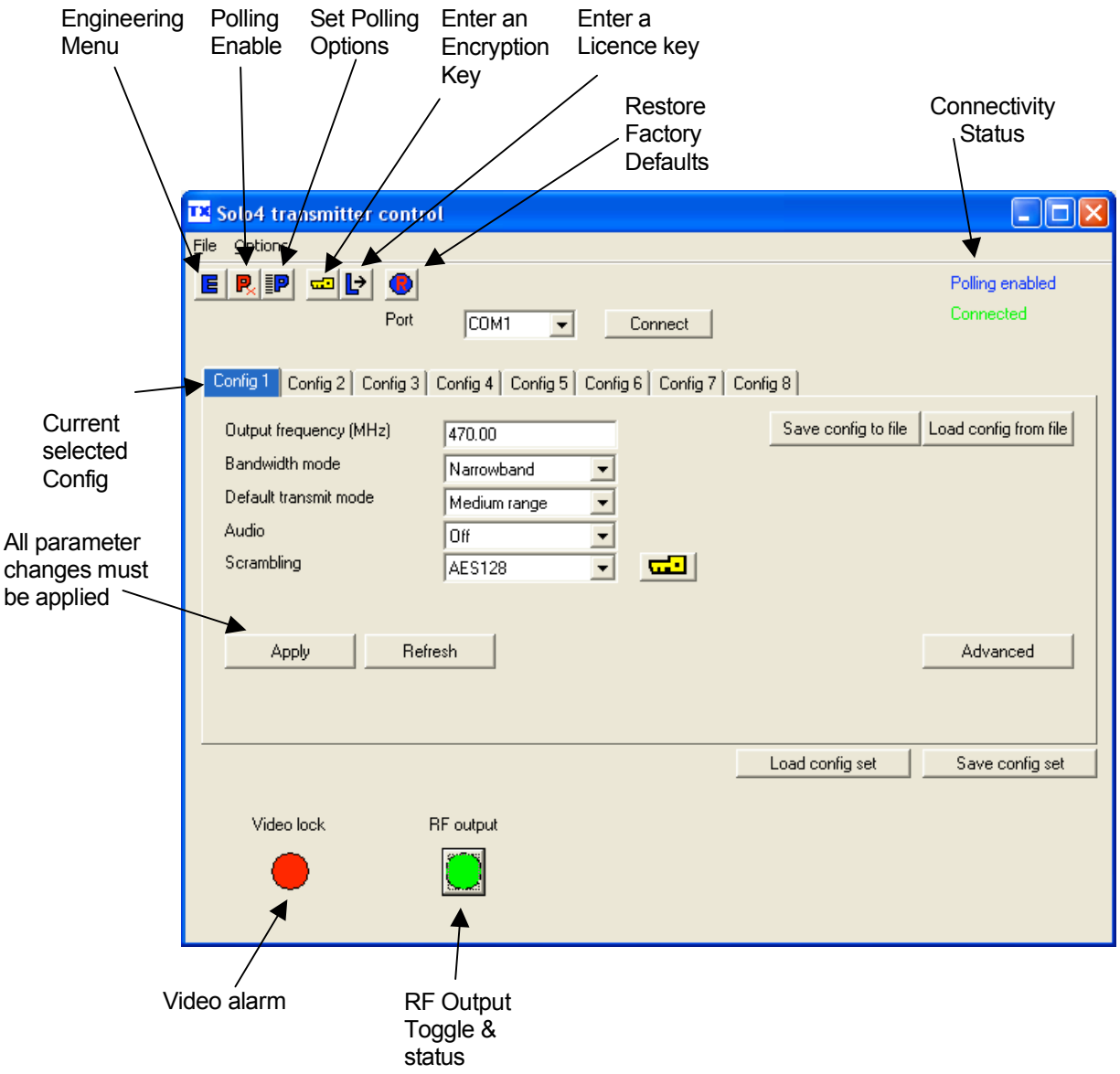
Changes are only applied to the unit when the “Apply” button is clicked.

Current values, as running in the unit, can be read using the “Refresh” button.

Parameters that are status information only appear in grey in the application.

Further engineering and configuration controls can be found within the “Options” and “File” drop down menus in the application title bars.

3.2 Transmitter Control Application



The 'Advanced' button allows the user to navigate to the controller page which exposes all available Transmitter settings.

Output Frequency (MHz)

The transmit frequency can be changed by entering the new desired frequency in this field. Values outside the range supported by a particular transmitter type will be rounded to the highest of lowest supported frequency as appropriate.

The transmit frequency can be set in step sizes of 250 kHz.

Bandwidth Mode

The Bandwidth Mode switches the unit between either domo Narrowband (2.5 MHz or 1.25 MHz channel bandwidths) or DVB-T 8MHz bandwidth. To select 6 MHz and 7 MHz DVB-T modes the user must first click on 'Advanced' to enter the Advanced setting page.

Audio

Turns 'On' or 'Off' a basic audio setting – the audio settings are optimised considering the bit-rate of the selected Transmit mode. The user can set there own audio settings using the 'Advanced' page, if required.

Default Transmit Mode

In Narrowband the user has the following pre-defined modes available from the main window. Note that the Ultra Long Range Mode is only available to users who have purchased the SOLO4TXUP option (1.25MHz and MPEG-4 modes). The user can of course define their own specific FEC, bandwidth and modulation requirements from the 'Advanced' page.

Ultra Long Range:	1.25MHz QPSK FEC 1/3 (optional)
Long Range:	2.5MHz QPSK FEC 1/3
Medium Range:	2.5MHz QPSK FEC 2/3
Short Range:	2.5MHz 16QAM FEC 2/3

In DVB-T the available modes are

QPSK ½ FEC 8MHz 1/32 Guard Interval

QPSK ¾ FEC 8MHz 1/32 Guard Interval

16QAM ½ FEC 8MHz 1/32 Guard Interval

Scrambling

If the AES scrambling option has been purchased for the robust SOLO4 system in use, then it is possible to encrypt the link. Scrambling must be enabled at the transmitter by selecting either AES128 or AES 256 in the scrambling field. The actual scrambling key can then be entered by clicking on the yellow 'key' icon.

File Options

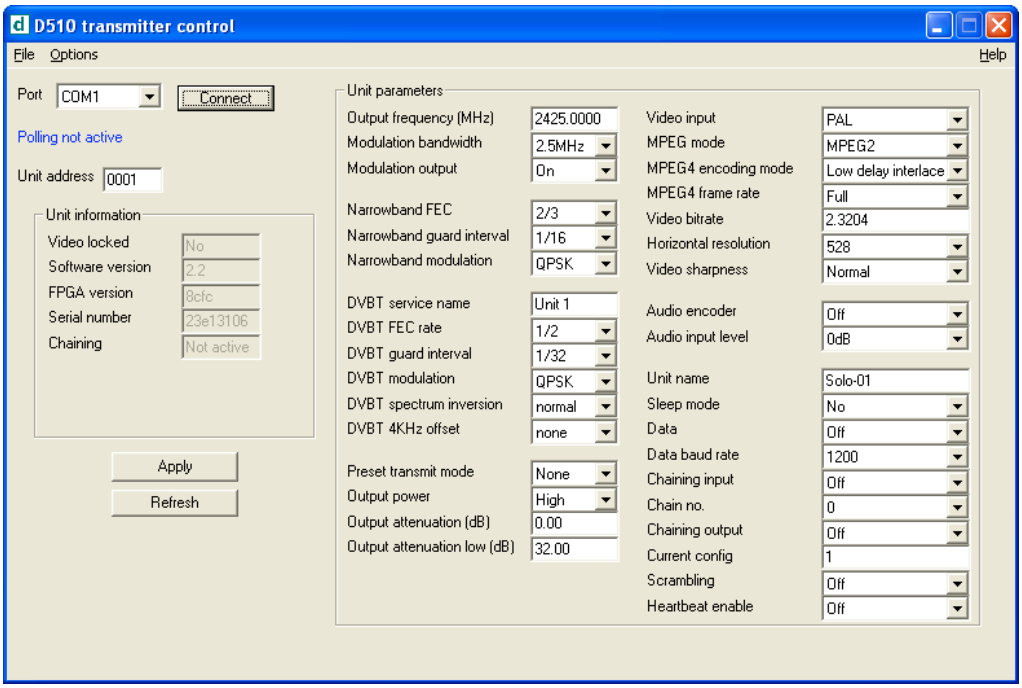
Load Config – used for loading a single configuration data from text file.

Save Config - used for saving configuration data to text file.

Load Config Set – used for loading all 8 configurations from a text file

Save Config Set - used for saving all 8 configurations to a text file

Advanced TX Controller Window



Output Frequency (MHz)

The transmit frequency can be changed by entering the new desired frequency in this field. Values outside the range supported by a particular transmitter type will be rounded to the highest of lowest supported frequency as appropriate.

The transmit frequency can be set in step sizes of 250kHz.

Modulation Bandwidth

For the robust SOLO4 transmitter products, the modulation bandwidths 8, 7, 6 or 2.5MHz can be selected. If the Ultra Narrow band upgrade has been purchased the 1.25MHz will also be available to select.

The normal mode of operation is 2.5MHz.

Modulation Output

This control is used to turn on and off the RF output. After a configuration change, the output always reverts to OFF.

Narrow Band FEC

This option applies to SOLO4 transmitters only. The default FEC is 2/3, however improved range operation can be achieved by selecting FEC 1/3. FEC 1/3 will improve signal range by 3dB. However FEC 1/3 reduces link capacity to 1.2Mb/s therefore reducing picture quality.

FEC	Link Bitrate	Sensitivity
2/3	2.4Mb/s	-99dBm
1/3	1.2Mb/s	-102dBm

Narrow Band Guard Interval

This option applies to SOLO4 transmitters only. The Guard Interval defaults to 1/16. Interval 1/8 is also available for very long range (aircraft downlinks) applications.

Narrow Band Modulation

This option applies to SOLO4 transmitters only. The COFDM mode can be changed between QPSK and 16QAM. QPSK is the default mode and will give the strongest most rugged RF link performance. Selecting 16QAM reduces the link performance by 5dB but improves the link data throughput, giving significantly better video quality.

Note: The terminology DVB-T refers to the 8,7,6MHz wide bandwidth modulation employed in the SOLO2 products. The SOLO4 product is also capable of DVB-T, but this mode is not recommended for normal operation

DVB-T Service Name

Applicable in DVB-T mode only, defaults to Unit 1. This should not be changed in normal operation

DVB-T FEC

Applicable in DVB-T mode only, the default FEC is ½. Other FEC rates will all reduce the range of the product, but will improve image quality and capacity of the link.

DVB-T Guard Interval

Applicable in DVB-T mode only. The Guard Interval defaults to 1/32. Other guard intervals such as 1/16 or 1/8 are available for very long range (aircraft downlinks) applications.

DVB-T Modulation

Applicable in DVB-T mode only, the COFDM mode can be changed between QPSK, 16QAM and 64QAM. QPSK is the default mode and will give the strongest most rugged RF link performance. Selecting 16QAM reduces the link performance by 5dB but improves the link data throughput, giving significantly better video quality.

Output Attenuation

This control can be used to make minor adjustments to the output power level, but in normal operation should be disregarded.

Video Input

This control is used to select the composite video input standard. Options are PAL, and NTSC both with and without 7.5 IRE pedestal.

MPEG Mode

The default encoding mode is MPEG2, however for SOLO4 products if the Ultra Narrow Band upgrade has been purchased, then MPEG4 will also be available. It is recommended that MPEG4 be employed when the unit is operating at low bitrates (2.5MHz bandwidth FEC1/3 or 1.25MHz bandwidth FEC1/3).

MPEG4 Encoding Mode

This option is only available on SOLO4 products installed with the Ultra Narrow Band Upgrade. This defaults to low delay interlace. Other modes are available but advice should be sought from domo before selection.

MPEG4 Frame Rate

This option is only available on SOLO4 products installed with the Ultra Narrow Band Upgrade. This option allows the user to select lower frame rate encoding (1/2 frame rate, ¼, 1/8 etc) It is recommended that MPEG4 reduced frame rates be employed when the unit is operating at low bitrates (1.25MHz bandwidth FEC1/3).

Video Bit-rate

This control can be used to set the video bit-rate within the constraints of capacity available in the channel, but only when “Chaining Input” is set to ON.

For normal SOLO transmitters, chaining CANNOT be enabled, and as such video bit rate control is automatic.

The video bit rate is automatically maximised in each configuration when “Chaining Input” is turned off.

Horizontal resolution

The video coding resolution can be selected from 704, 528, 480 and 352 pixels. Changing the horizontal resolution to lower values will make the coded picture softer.

Care should be taken to match the horizontal resolution to the resolution of the camera connected to the transmitter; this will give best image results.

Audio Encoder

The Audio can be turned on and off with this control. Audio is OFF by default, but there are several audio modes that vary from very high quality to speech grade that can be selected with this control. Enabling audio will degrade the video quality, because some of the available data capacity is diverted away from video to audio. Selecting high fidelity audio modes will degrade the video quality more than lower fidelity audio modes. The Audio encoder can also be switched to 32 kHz and 48 kHz MPEG Layer 1 modes; from software V3.3 upwards.

Note: The Solo4 receiver only supports 48 kHz sampling in MPEG Audio mode and bit-rates in the range 192 to 448kbits/s.

Audio Input Level

This control is used to define the audio gain to be applied to the audio input signal. 0dB is used for line level audio and various options up to 48dB of gain can be applied for microphone inputs.

Unit Name

This field allows the user to enter an identifier for the service that they wish to transmit. This must match that selected at the receiver for the service to be decoded. The unit name can be constructed of any eight ASCII characters.

Sleep Mode

This control allows the unit to be forced into a Sleep Mode where main functions are disabled, and the power consumption is significantly reduced.

Data

With this ON / OFF control the user can select whether the transmitter passes serial RS232 data across the RF link to the receiver.

Data Baud Rate

This field is used to select the baud rate of any RS232 serial data component to be passed from the transmitter to the receiver across the RF link.

Chaining Input

This control is not used in current SOLO products.

Chain Number

This control is not used in current SOLO products.

Current Config

This field reports the last loaded configuration number. Note that for the SOLO transmitter, changes applied after the configuration has been loaded are saved immediately into the current configuration.

Scrambling

If the AES scrambling option has been purchased for the SOLO4 system in use, then it is possible to encrypt the link. Scrambling must be enabled at the transmitter by selecting either AES128 or AES 256 in the scrambling field. At this point the user will need to ensure that the correct key is in use and this is done by using **Options / Write AES Key**.

The key is a 128bit key for AES128 and a 256bit key for AES256 and is entered as either 32 or 64 ASCII hexadecimal characters (0..F).

Video Locked (Status Only)

This status information indicated whether the transmitter is successfully locked to the incoming composite video signal. Unlocked status may indicate cabling faults, or poor quality incoming video feeds to the unit.

Software Version (Status Only)

This status information describes the version of the software running the SOLO transmitter product.

FPGA Version (Status Only)

This information is for domo engineering use only.

Serial Number (Status Only)

This status information is the electronic serial number of the transmitter PCB. This number can be exchanged with domo to purchase extra licensable features, such as upgrades to support AES encryption.

Chaining (Status Only)

This field reports the status of the chaining input to the SOLO transmitter, and is not active in current units.

Options

Engineering – provides access to further diagnostic and calibration features. The **Diagnostic** and **Power calibration** pages must not be altered. The **Advanced Options** under the Engineering menu allow the user to **Change RS232 address**, which can be useful when connecting multiple units together via a multi drop RS485 bus for control purposes. The **Serial control** dialogue box allows the user to change timeouts used during the serial communications between the unit and the controller.

Enable Polling – selecting this option makes the control application automatically refresh the data presented to the user every few seconds.

Polling Options – selecting this option allows the user to define parameters to be regularly polled.

Write Encryption Key – opens a dialogue box for entering an ABS or AES scrambling key, as 32 ASCII hexadecimal characters (0…F)

Write License Code – open a further box for entering license codes for the activation of licensable features (e.g. AES scrambling) in the transmitter. Contact domo for support in applying new licenses as required.

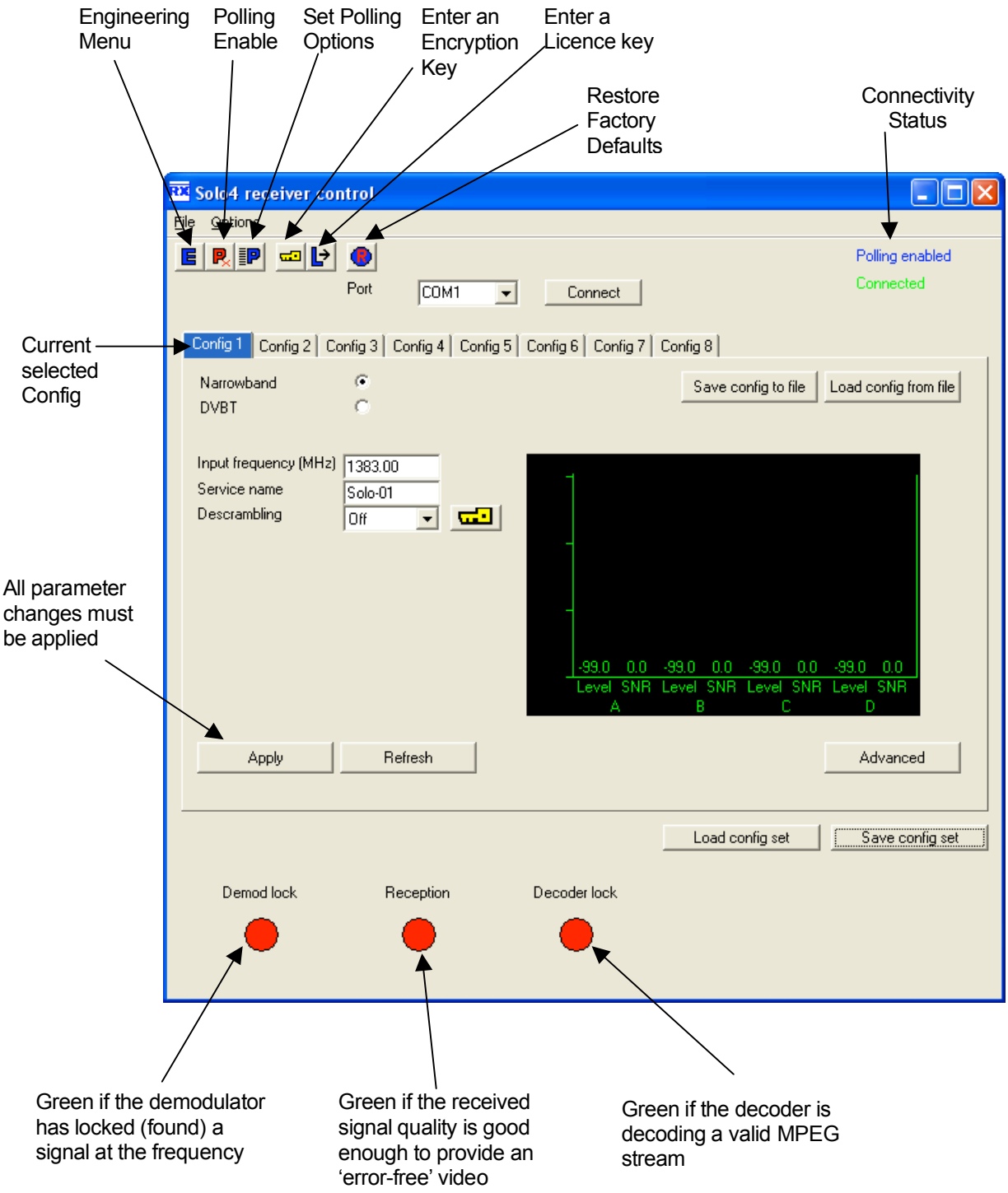
Restore Defaults – restores factory default settings in the transmitter.

File

Set Icon Source, Set logo source, Set logo size and Set application title – allow the user to define a controller branding

Exit – exits the SOLO transmitter control application

3.3 Receiver Control Application



The 'Advanced' button allows the user to navigate to the controller page which exposes all available Transmitter settings.

Bandwidth Mode (Narrowband or DVB-T)

The Narrowband and DVB-T radio selections switch the unit between either domo Narrowband (2.5 MHz or 1.25 MHz channel bandwidths) or DVB-T 8MHz bandwidth. To

select 6 MHz and 7 MHz DVB-T modes the user must first click on ‘Advanced’ to enter the Advanced setting page.

Input Frequency (MHz)

The receive frequency can be changed by entering the new desired frequency in this field. Values outside the range supported by a particular transmitter type will be rounded to the highest of lowest supported frequency as appropriate.

The receive frequency can be set in step sizes of 250 kHz.

Service Name

This field allows the user to enter an identifier for the service that they wish to receive. This must match that selected at the transmitter (Unit name) for the service to be decoded. The service name can be constructed of any eight ASCII characters.

Descrambling

If the AES scrambling option has been purchased for the SOLO2 or SOLO4 system in use, then it is possible to decrypt the link. Descrambling must be enabled at the receiver by selecting either AES128 or AES 256 in the descrambling field. The actual descrambling key can then be entered by clicking on the yellow ‘key’ icon.

File Options

Load Config – used for loading a single configuration data from text file.

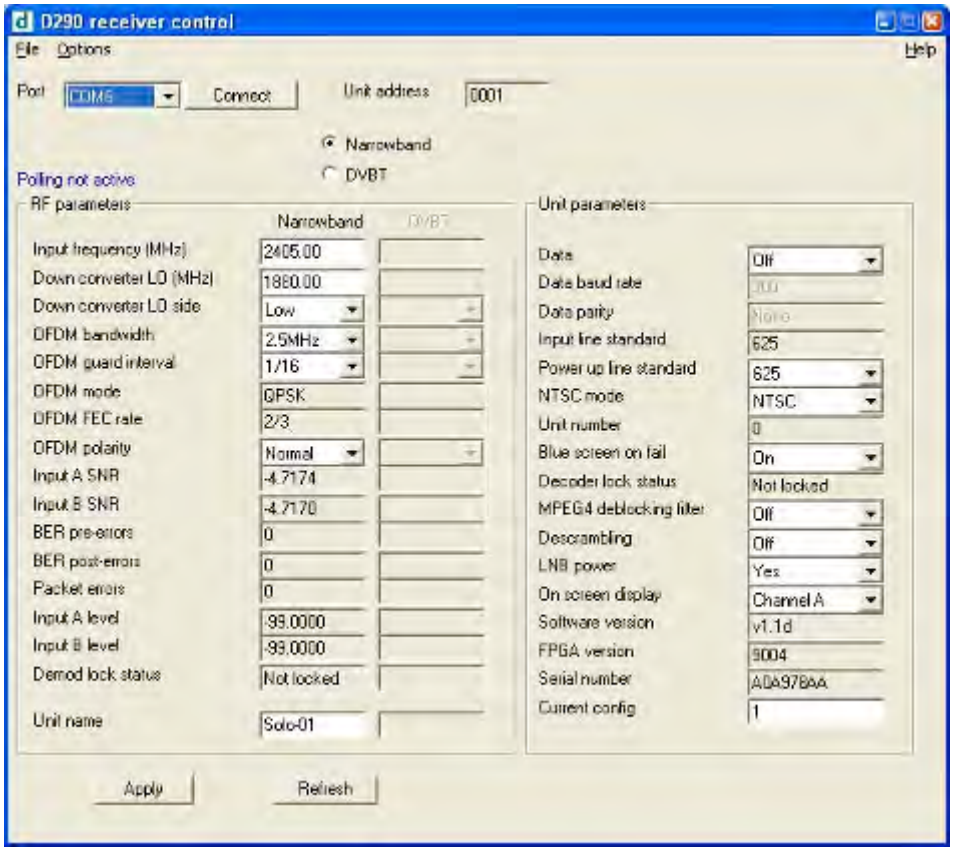
Save Config - used for saving configuration data to text file.

Load Config Set – used for loading all 8 configurations from a text file

Save Config Set - used for saving all 8 configurations to a text file

On a receiver there are 8 separate configurations for Narrowband and 8 separate configurations for DVB-T.

Advanced RX Controller Window



Note: The terminology DVB-T refers to the 8,7,6MHz wide bandwidth modulation employed in the SOLO2 products. The SOLO4 product is also capable of DVB-T, but this mode is not recommended for normal operation

Narrowband / DVB-T

The SOLO4 receiver is capable of receiving transmissions in Narrowband and DVB-T. For receiving the transmissions from a SOLO2 transmitter the 'DVB-T' radio button should be selected. For receiving the transmissions from a SOLO4 transmitter the 'Narrowband' radio button should be selected.

When the 'Narrowband' radio button is selected, then the 'Narrowband' column of parameters will become highlighted, and can be set.

If the 'DVB-T' radio button is selected, then the 'DVB-T' column of parameters will become highlighted, and can be set.

Input Frequency

The receive frequency can be changed by entering the new desired frequency in this field.

Down converter LO

This field allows definition of the local oscillator frequency in the connected downconverters.

For domo supplied downconverters, this should be set as follows:

- 1880MHz for S band transmissions (2.28 to 2.55GHz)
- 1700MHz for L band transmissions (1.15 to 1.4GHz).

Down converter LO side

This field allows definition of the local oscillator side.

For domo supplied downconverters, this should be set as follows:

- LOW for S band transmissions (2.28 to 2.55GHz)
- HIGH for L band transmissions (2.28 to 2.55GHz)

OFDM Bandwidth

This field displays the width of the received OFDM signal and should be set to 2.5MHz for normal SOLO4 system operation, and should be set to 8MHz for normal SOLO2 system operation.

OFDM Guard Interval

In this field the user selects the guard interval which matches the transmitter. For SOLO4 systems typically a guard interval of 1/16 is used, however on very long range transmissions a guard interval of 1/8 may be employed. For SOLO3 systems typically a guard interval of 1/32 is used, however on very long range transmissions a guard interval of 1/8 may be employed.

OFDM Mode (Status Only)

This field displays the COFDM constellation that is being demodulated at the receiver. In normal operation this will match that selected at the transmitter.

OFDM FEC (Status Only)

This field displays the COFDM FEC (Forward Error Correction) that is being demodulated at the receiver. In normal operation this will match that selected at the transmitter.

Input SNR (Status Only)

For each IF input, the SNR (Signal to Noise Ratio) is reported. Values in the order of 18dB to 22dB represent strong received signals, whilst values in the order of 5dB represent poor received signals which will likely give rise to decoding errors.

BER Pre Viterbi (Status Only)

This figure is for engineering use and gives a representation of the error rate prior to the error correction techniques having been applied in the receiver.

BER Post Viterbi (Status Only)

This figure gives a measure of the bit error rate after error correction techniques have been applied in the receiver. Any numbers greater than 0 in this field indicate the presence of un-correctable errors in the received stream, and thus picture glitching and audio artefacts will occur.

Input Level (Status Only)

This figure indicates the received signal level at the two receiver inputs. Normal Operation will occur when the input level is between –15 and –90 dBm. Signals greater than –15 may be too powerful and cause damage. Signal less than –90dBm may be too weak and cause picture loss (typical link failure will occur between –95 and –99dBm).

Demod Lock Status (Status Only)

This indicates whether the demodulators are successfully locked to the RF signal.

Data

With this ON / OFF control the user can select whether the receiver extracts any data component that may be in the transmitted stream. Such data components are presented at the receiver DATA output port.

Data Baud Rate (Status Only)

This field reports the baud rate of any RS232 serial data component that is present and selected in the stream.

Input Line Standard (Status Only)

This field reports the line standard that is currently being, or last was, decoded.

Power Up Line Standard

Using this field the user can select what line standard of video the receiver will output (PAL / NTSC) when the receiver is first powered on and before it has locked to an incoming RF signal.

NTSC Mode

With this control, when running in 525 line mode, the user can select whether the NTSC composite output video has a 7.5 IRE pedestal applied.

Blue Screen on Fail

When the link fails, the user can select between a blue field video output (YES), and a freeze frame (NO) with this option.

Unit Name

This field allows the user to enter an identifier for the service that they wish to receive. This must match that selected at the transmitter for the service to be decoded. The unit name can be constructed of any eight ASCII characters.

Descrambling

If the AES scrambling option has been purchased for the SOLO system in use, then it is possible to encrypt the link. Descrambling must also be enabled at the receiver by selecting AES128 or AES256 in the descrambling field. At this point the user will need to ensure that the correct key is in use at the receiver and this is done by selecting **Options / Write AES Key** in the receiver controller.

The key is a 128bit value for AES128 and a 256bit value for AES256, and is entered as 32 or 64 ASCII hexadecimal characters (0...F).

Decoder Lock Status (Status Only)

This field reports whether the video decoder is successfully locked to the incoming digital bit stream.

Current Config

This field allows the user to select which of the 8 memory configs the receiver is operating in. The receiver has 8 stored configurations and the user can move between them by setting the appropriate number in this field. Changes made to other settings by the user will automatically be stored in the configuration number indicated by this field.

Serial Number (Status Only)

This status information is the electronic serial number of the transmitter PCB. This number can be exchanged with domo to purchase extra licensable features, such as upgrades to support AES decryption.

Software Version (Status Only)

This status information describes the version of the software running in the SOLO transmitter product.

FPGA Version (Status Only)

This information is for domo engineering use only.

Chaining

Chaining allows multiple services to be sent via one RF link. A receiver may be connected to a transmitter to form a chaining or relay link. To allow this, the chaining interfaces provided on the first receiver must be connected to the second transmitter. Three modes of operation are supported - no chaining (default), chaining mode, and relay mode. The chaining mode allows two services (remote and local) to be combined.

The relay mode allows just the remote service to be transmitted turning off the local service.

For chaining mode to operate correctly, the second unit in the chain must operate at twice the transmit data rate from the first. If the first unit is operating in QPSK rate 2/3 the second unit must operate in 16QAM rate 2/3. If the first unit is operating in QPSK rate 1/3 the second unit must operate in QPSK rate 2/3. The units must have different chaining numbers selected, and the different unit names. For the relay mode to operate correctly the second unit must have the transmit rate greater or equal to the first unit.

Chaining is a licensable feature.

Options

Engineering – provides access to further diagnostic and calibration features. The **Diagnostic** dialogue box must not be altered. The **Advanced Options** dialogue box under the Engineering menu allows the user to **Change RS232 address**, which can be useful when connecting multiple units together via a multi drop RS485 bus for control purposes. The **Serial control** dialogue box allows the user to change timeouts used during the serial communications between the unit and the controller.

Enable Polling – selecting this option makes the control application automatically refresh the data presented to the user every few seconds.

Polling Options – selecting this option allows the user to define parameters to be regularly polled.

Write Decryption Key – opens a dialogue box for entering an ABS or AES scrambling key, as 32 ASCII hexadecimal characters (0…F)

Write License Code – open a further box for entering license codes for the activation of licensable features (e.g. AES scrambling) in the transmitter. Contact **domo** for support in applying new licenses as required.

Restore Defaults – restores factory default settings in the transmitter.

File

Set Icon Source, Set logo source, Set logo size and Set application title – allow the user to define a controller branding

Exit – exits the SOLO receiver control application

4 NETSTREAM IP Output Option

4.1 General Info

This section is relevant only to customers that have the **NETSTREAM** option fitted in their SOLO4 robust receiver.

The **NETSTREAM** product features an Amphenol 4-pin socket for connection to 10 Base T or 100 Base T Ethernet networks using the supplied cable which ends in a standard RJ45 connector. The network interface automatically switches between 10 Base T and 100 Base T as required.

The connector is wired for straight connection to a network Hub and does not automatically compensate for Ethernet crossovers. If a direct connection to a PC is required, then an Ethernet cross over cable should be used.

4.2 Streamer

The main use for the **NETSTREAM** card is to allow viewing of the received video/audio signal on a standard PC (or laptop) running the **domo** software decoder software (part number **NETSWDR**).

Data is transmitted over the Ethernet network by means of “multicasting” i.e. continuous real-time streaming of packets accessible to any PC connected to the network.

It is therefore possible for more than once connected PC to view the streamed data simultaneously.

Two types of multicast IP packets are streamed.

- Packets carrying video, audio and data as received by the unit;
- Packets known as Session Announcement Protocol and Sessions Description Protocol data (SAP and SDP), which contain information regarding the nature and location of the stream itself.

4.3 Web Server

The unit features a web server, which can be used to change the configuration of the streaming parameters.

The default IP address of the unit when delivered is 192.168.0.71

A standard Internet browser can be used to reach the configuration page of the unit.

The URL of the configuration page is http://192.168.0.71/index.htm

Note that the address of the index page will change in the instance that the NETSTREAM IP address is subsequently changed. There is no RS232 serial communications available on the NETSTREAM card when it is mounted in the domo Solo4 Robust receiver. Therefore it is recommended that the user keeps the IP address set to the default address. Having multiple units with the same IP address on the same network is possible as the card will only be streaming UDP packets. However, if the user wishes to communicate with individual NETSTREAM cards then each will have to be assigned a unique IP address and the customer MUST keep note of the addresses associated with each robust receiver unit.

To access the control page, the user is required to follow a login procedure.

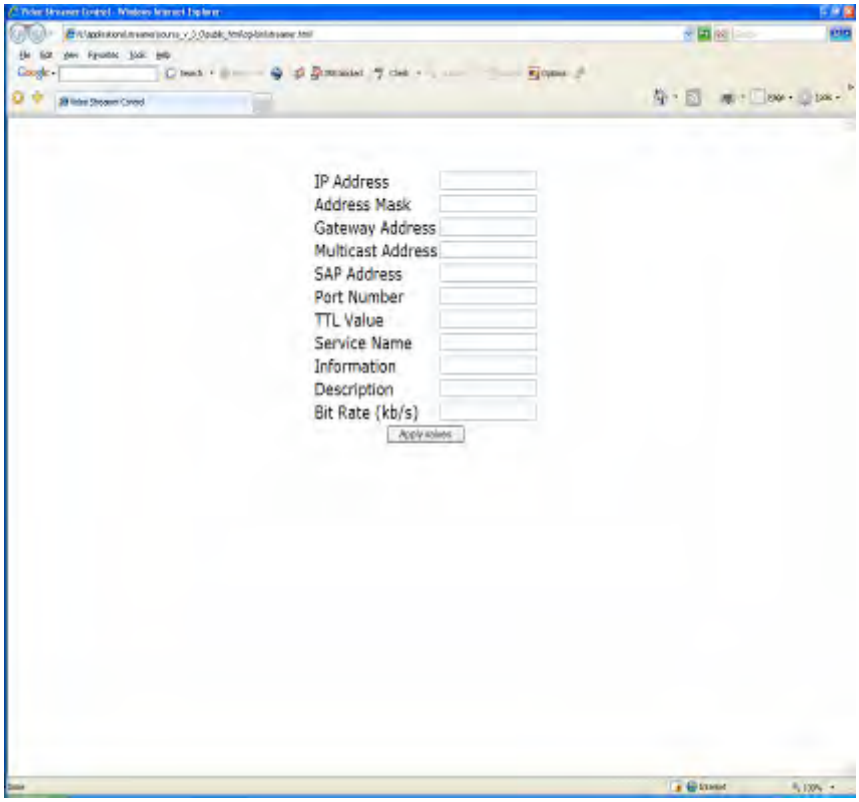
Connect to 192.168.0.62
The server 192.168.0.62 at cgi-bin requires a username and password.
Warning: This server is requesting that your username and password be sent in an insecure manner (basic authentication without a secure connection).
User name:
Password:
Remember my password
OK
Cancel

When prompted, enter the following login details:

User Name: admin

Password: ipradio

The browser will display the page shown below:



IP Address

This control allows the user to change the IP address of the unit. The factory default value is 192.168.0.71.

The user should make a note of the unit's new IP address when changing it. Failure to do so will result in an inability to use the web browser interface until the unit's new IP address is recovered.

Multicast Address

This control allows the user to change the multicast address used by the unit. The default value is 239.16.33.254.

Port Number

This control allows the user to change the multicast port used by the unit. The default value is 10000.

TTL

This control allows the user to change the value of the IP TTL (Time to Live) set by the unit.

SAP Address

This control allows the user to change the value SAP/ SDP multicast address used by the unit. The default value is 224.2.127.254 and the port used is 9875. These are standard multicast values for such parameters, and it is recommended they are not changed unless specifically required due to routing restrictions.

SAP / SDP Data

Note – SAP is Session Announcement Protocol and SDP is Session Description Protocol as defined in RFC2327 and RFC2974

- **Service Name** – textual information naming the multicast stream as delivered in the SAP/SDP packets from the unit. Default is "*MPEG Stream*"
- **Info** – further textual information about the multicast stream as delivered in the SAP/SDP packets from the unit. Default is "*NetEng"*
- **Description** - Optional URI (Universal Resource Identifier) pointing to a web page on the network containing additional information about the multicast. Default is *www.domo.co.uk*
- **Bitrate** - textual information indicating the bitrate in kbits/s of the stream. Default is usr kbit/s

5 Software Decoder

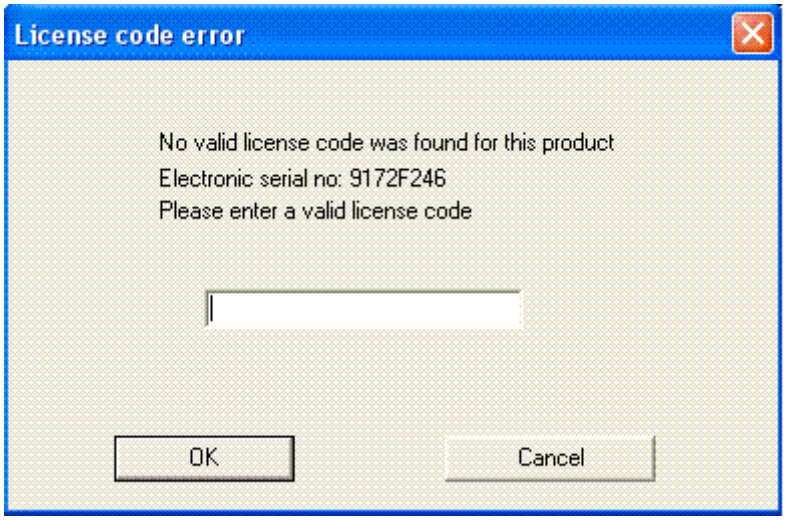
5.1 General Information

The domo software decider application (part number **NETSWDR**) is delivered on CD. The product is installed by following the prompts offered by a comprehensive Install Shield.

The product is licensed, after installing the product from the Installation shield the user should double click on the application icon, which may appear as depicted below.

Note – later revisions of the software decoder may feature different icons or application names.

When the application is executed, if the PC is unlicensed then the following prompt box appears


License code error
No valid license code was found for this product
Electronic serial no: 9172F246
Please enter a valid license code
OK
Cancel

Assuming the user has pre-paid for their Software decoder licence then the user then simply needs to email the Electronic Serial number to domo (sales@domo.co.uk) quoting the pre-paid token number. After receipt of this email domo will then provide a licence key. The licence key should be entered into the prompt box in the application window above which will licence the PC.

The license is tied to the target PC, and reinstallation of the product on a different machine will require the purchase of further licenses from domo.

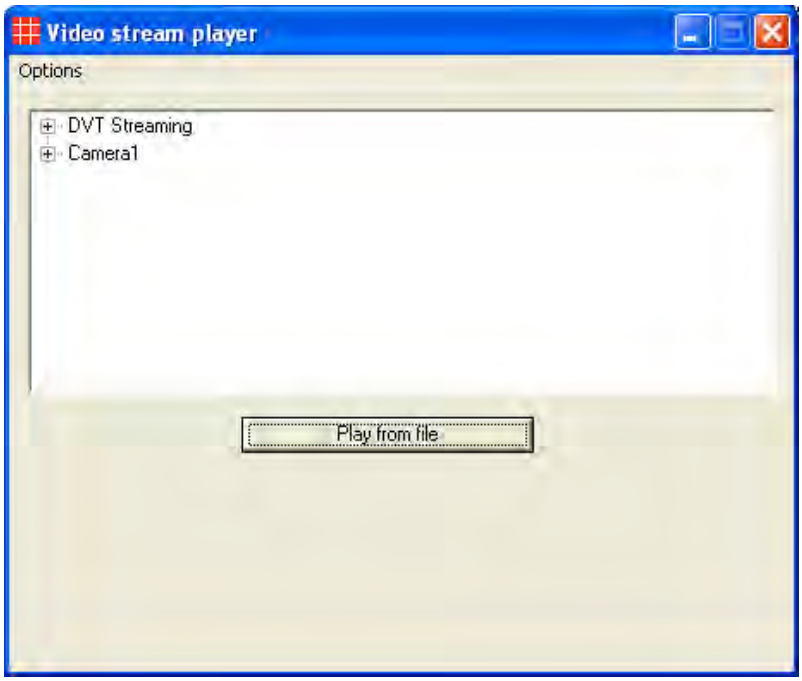
Note – if a user has not purchased a pre-paid licence then the user will have to contact domo sales to purchase a licence prior to receiving a licence code.

The domo software decoder can decode and present MPEG streams that are available from two sources.

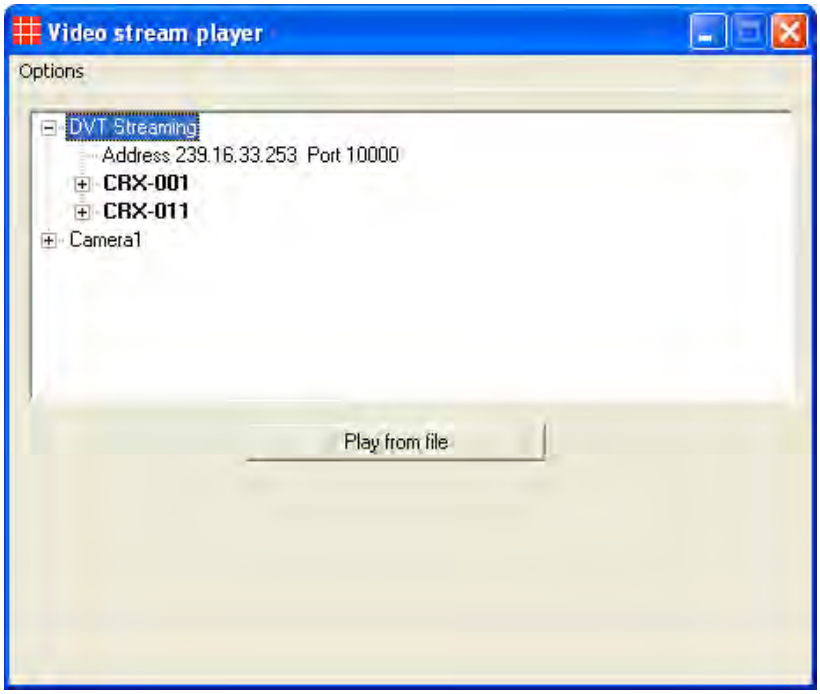
- Multicast streams being played out on the connected network by a NETSTREAM or NETCRXIPUP IP upgrade in the CRX.
- Files available locally on the target PC or network.

5.2 Decoding Multicast Streams

If the application is started on a PC, which is connected to a network shared by the NETSTREAM or CRX IP stream, then it will present a view of available streams that can be software decoded and viewed on the PC.

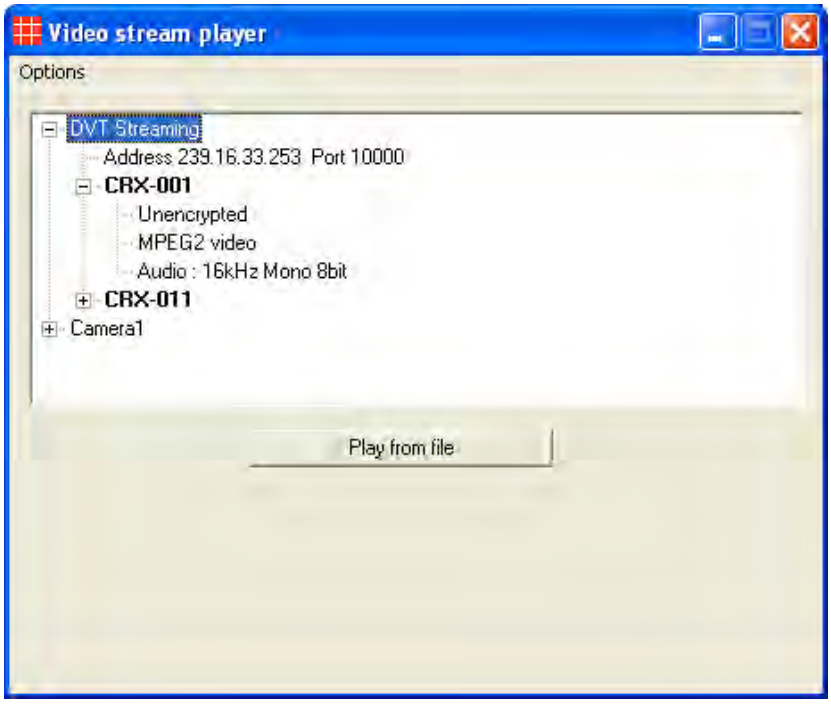


The name of the multicast stream is listed in the window, alongside an expandable crosshair. Clicking the crosshair presents the streams multicast details and a list of any services contained within a stream:



In the above example the stream “DVT Streaming” has a multicast address of 239.16.33.253 and is streaming to port number 10000. It contains two services, named “CRX-001” and “CRX-002”.

It can be seen that there is an expandable crosshair alongside each of the service names. Clicking these provides more details about each service:



In this case we see that the service “CRX-001” is unencrypted, uses MPEG2 video encoding, and has single channel (mono) audio encoded with an 8-bit companding scheme with a sampling rate of 16kHz.

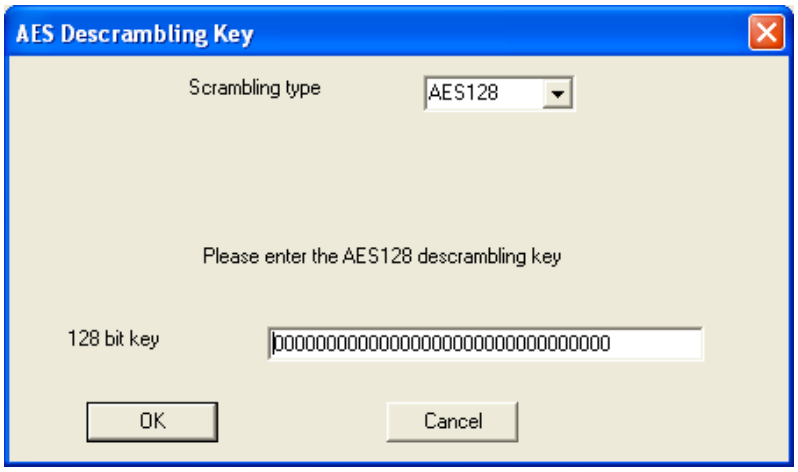
To start decoding a service the user should “double click” the appropriate service name. Service names are always highlighted in bold text in the main player window. If the service is unencrypted the main decoder window will be launched.

5.3 Encrypted Streams

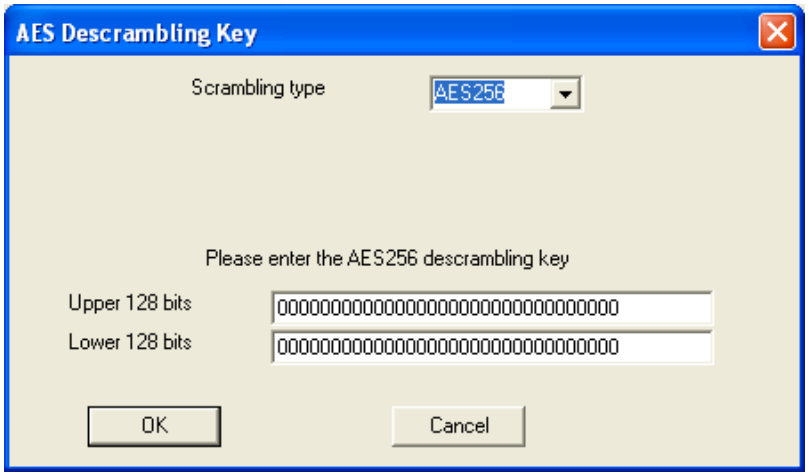
If the service selected is being encrypted by upstream hardware, then the user will be prompted for the reciprocal key. The video stream player can detect from information in the stream whether ABS or AES encryption is being used. It will present a window appropriate to the type of encryption. For ABS the following window will appear:

This requires the 32-bit ABS decryption key to be entered as 8 hexadecimal characters. This is not case sensitive.

Although the player is able to distinguish a service encrypted with AES, it cannot detect whether 128-bit or 256-bit AES encryption has been used. Therefore the following window will be presented to the user when AES encryption is detected:



By default this window is expecting a 128-bit (to be entered as 32 hexadecimal characters) decryption key. If the service is encrypted with AES256 encryption, the user should select this from the “Scrambling type” drop-down list in the window. The appearance of the window will then change to the following:

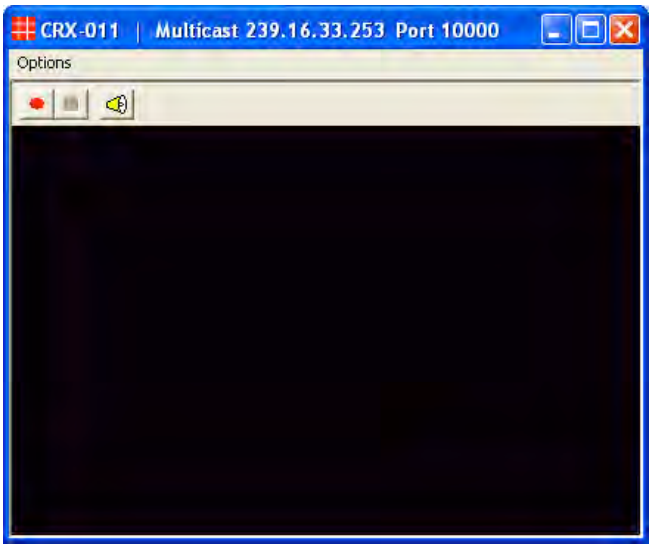


The user can now enter the AES256 key in the two fields provided.

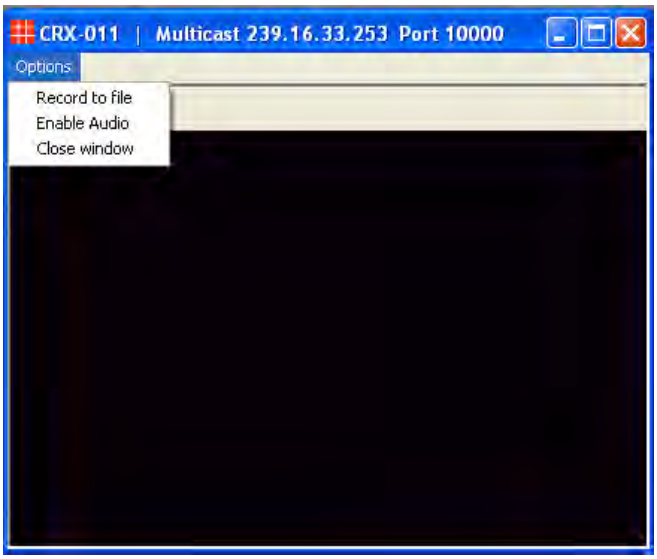
Once the key is entered, the main decoder window will be launched.

5.4 Main Decoder Window

The main decoder window will appear as follows:



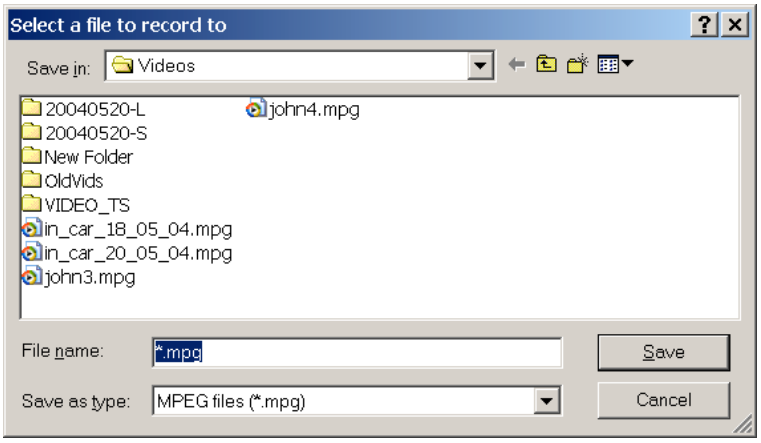
The title bar of the window presents the service name and the streams multicast details. Below this there is a menu-bar with an **Options** drop-down menu and a toolbar with some icons on it. Each of the icons corresponds to a selection in the **Options** menu. The following selections are available in the menu:



Record to file

This option gives the user the option of recording the file that is being decoded to disk.

The user is prompted with a standard Windows “File Save” dialog box:



When recording is active, this menu option is changed to “Stop Recording” which can be used to stop writing to disk.

Two buttons on the toolbar can be used to control recording:

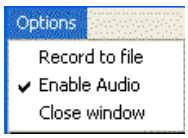
to start recording

to stop recording

When recording is inactive, the stop recording button will appear greyed out and unselectable. The start recording button will appear in similar fashion when recording is active.

Enable audio

This option will only appear in the menu if the service has audio. When more than one service includes audio only one window can decode audio at any one time. When audio is enabled in a service, the enable audio option will appear with a tick beside it in the menu:



Selecting this option simply toggles whether audio is enabled or disabled. If another window was previously decoding audio it will be forced to disable its audio as the new window is now the audio decoding window.

When audio is enabled, the button will appear on the toolbar. Clicking this button will disable audio. When audio is disabled this button will change its appearance and appear as , clicking which will enable audio.

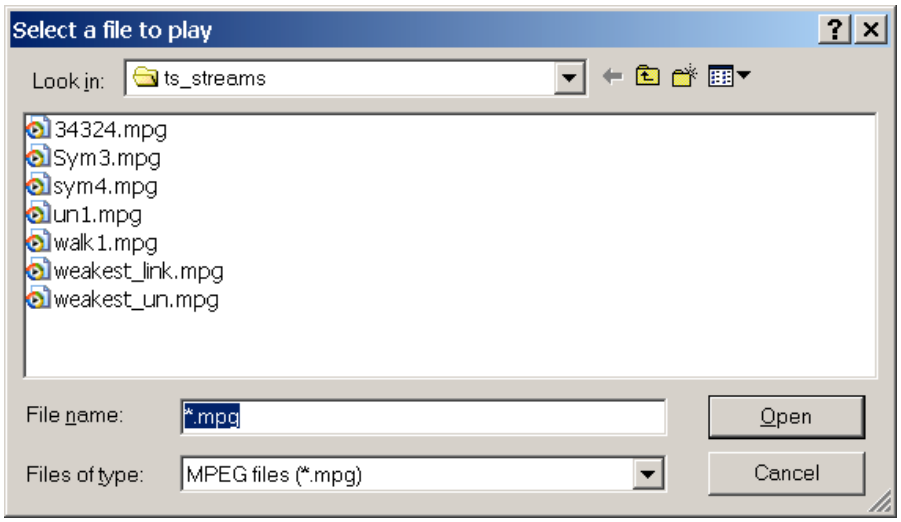
Close window

This closes the main decoder window.

5.5 Decoding Locally Stored Files

If the user wishes to play a file from local storage (regardless of whether multicast streams are available or not) then the “Play from File” button on the main application window should be pressed.

This opens a standard Windows “Open File” dialog box to make the selection.



Note - the default file extension is ***.mpg.***

The application will scan through the selected file for any services available. If the stream contains only one service the application will select this automatically and operation will be as described in the preceding sections after a service is selected.

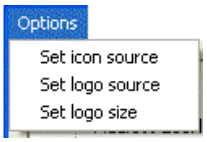
If there are multiple services in the file the application will present a pop-up window with a list of the services in:

Please select a service
This stream contains multiple services. Please select one from the list below to play.
Solo-01
Solo-02
Solo-04

The user should “double-click” the service they wish to decode. Thereafter, operation is as described in the preceding sections.

5.6 Miscellaneous application options

The main application window has a menu-bar with an **Options** drop-down menu. This presents the following selections:



These options relate to the main application icon, which normally appears as and an optional logo. By default there is no logo presented. The user may select a bitmap to appear as a logo below the “Play from file” button on the main application window.

Selecting either the “Set icon source” or “Set logo source” options will open a standard Windows file dialog box. For icon files, this is set to filter for files with a .ico file extension. These are standard Windows icon files. A 32 x 32 pixel icon is expected. For logo files, the dialog box is set to filter for bitmap files with a .bmp file extension. The size of the bitmap file is not important as the application will automatically make it fit to the available space. The logo size can be altered by selecting the “Set logo size” option in the menu.

6 Fault Finding

6.1 Indicated Faults

Robust SOLO4 Transmitter

LED Condition	Meaning	Action
ALARM LED lit permanently	Unit alarm, likely to be no video input lock	Ensure video source connected and of correct video standard (PAL/NTSC)

RobustSOLO4 Receiver

LED Condition	Meaning	Action
ALARM LED lit RF LED off	No RF Signal Lock	Check a suitable RF source is active, on correct frequency. Ensure antennas are connected to receiver. Ensure there is no interfering signal.
ALARM LED lit RF LED on	Has RF signal lock but no decoder lock	Check video is enabled at the transmitter. Check correct unit name is selected at the receiver to match the transmitter.
ALARM LED lit Lock LED lit RF LED on	Has RF signal lock but no decoder lock due to encryption of video	Check that scrambling keys are matched. Check video is enabled at the transmitter.

6.2 Fault Symptoms

Symptom	Suggested Action
No RF Link	Check a suitable transmitter RF source is active, on correct frequency. Ensure antennas are connected to receiver. Ensure there is no interfering signal.
Poor link performance	Poor performance of the link can occur for the following reasons. • Interference. Should an interfering RF signal occur on the same frequency the performance of the link will be affected. Remove the interferer e or move to an alternative frequency. • Unsuitable antennas, or out of band antennas. See the antenna sections for guidance on antenna selection and use. • Reduced transmit power, ensure that the attenuation setting on the transmitter is appropriate for direct output, or for amplifiers connected. • Receive antenna positioning, were possible mount the receive antennas away from other objects, unobstructed and as high as possible. Poor alignment of directional antennas. • No Diversity operation. Ensure both down converters are operational.
Blue screen at receiver	Receiver RF LED not lit - see “No RF Link” section Receiver RF LED lit. Check video is enabled at the transmitter. Check correct unit name is selected at the receiver to match the transmitter. Check scrambling keys are matched.
Reduced Image quality	Image quality is affected by the selected horizontal resolution. The image will become progressively softer for each horizontal resolution below the sharpest resolution of 704 pixels. It is advisable to select a horizontal resolution that matches the resolution of the camera. Image quality is also affected by the video bit rate which can be read from the video bit rate field of the SOLO transmitter controller). The standard setting is 2.3Mb/s. However enabling audio, particularly the high quality audio modes, will reduce the video bit rate substantially. Therefore ensure an appropriate audio mode is selected or audio is fully disabled if not required.
No audio	Ensure audio is enabled at the transmitter (disabled by default).

7 LED Indicators

Robust SOLO4 Transmitter

LED / Button	Colour	Meaning / Use
Alarm LED	Red	When lit indicates alarm or fault condition on equipment. Usually means no lock to incoming video.
Front Panel Lock LED	Yellow	When lit indicates service is encrypted
RF LED	Green	Transmitter: When lit indicates RF output is active.
LED 1 to 8	Green	Indicates which of the eight stored configurations is currently selected.
Range Mode LEDs	Green	SOLO4 Transmitter: Indicates range mode Ultra Long Range: 1.25MHz QPSK FEC1/3 (optional) Long Range: 2.5MHz QPSK FEC1/3 Medium Range: 2.5MHz QPSK FEC2/3 Short Range: 2.5MHz 16QAM FEC2/3

Robust SOLO4 Receiver

LED Condition	Meaning
Red ALARM LED lit RF LED off	No RF Signal Lock
Red ALARM LED lit RF LED on	Has RF signal lock but no decoder lock (stream probably encrypted with encryption not selected at receiver)
Red ALARM LED not lit	No alarms
RF LED lit	RF signal lock
RF LED not lit	No RF signal lock
Single CONFIG LED lit	Indicates selected config
No CONFIG LEDs lit	Unit Off

8 Connector Pin Outs

8.1 Robust Transmitter connectors

Combined Control/Data Connector – 7-pin Amphenol 62GB-57A-10-07-SN

Pin No	Function
A	RS232 Tx “Control” to PC (out)
B	Not used
C	RS232 Rx “Control” from PC (in)
D	Not used
E	0V
F	RS232 Tx “Data” to PC (out)
G	RS232 Rx “Data” from PC (in)

Audio Connector - 3-pin Amphenol 62GB-57A-08-03SN

Pin No	Function
A	Audio Right In
B	Audio Left In
C	GND

Power - 3-pin Amphenol 62GB-57A-08-33PN

Pin No	Function
A	+12 V
B	0 V
C	No Connect

Video - 4-pin Amphenol 62GB-57A-08-4SN

Pin No	Function
A	+12V (out)
B	0V (out)
C	Video GND
D	Video Signal

8.2 Robust Receiver

Combined Control/Data Connector – 7-pin Amphenol 62GB-57A-10-07-SN

Pin No	Function
A	RS232 Tx “Control” to PC (out)
B	Not used
C	RS232 Rx “Control” from PC (in)
D	Not used
E	0V
F	RS232 Tx “Data” to PC (out)
G	RS232 Rx “Data” from PC (in)

Video/Audio Connector - 7-pin Amphenol 62GB-57A-10-07SF

Pin No	Function
A	Video Out
B	Video GND
C	Audio (Right)
D	Audio (Left)
E	+12V output **(only 0.4Amp available!)**
F	0V
G	Audio GND

Power - 3-pin Amphenol 62GB-57A-08-33PN

Pin No	Function
A	+12 V
B	0 V
C	No Connect

Internet Protocol (IP) Connector – 62GB-57A-08-04PN

Pin No	Function
A	TX(+)
B	TX (-)
C	RX (+)
D	RX (-)

8.3 Robust 1W amplifier

Power - 3-pin Amphenol 62GB-57A-08-33PN

Pin No	Function
A	+12 V
B	0 V
C	No Connect

8.4 5W amplifier

Power - 4-pin PTO 4

Pin No	Function
A	+12 V DC (In)
B	FWD PWR
C	0V (In)
D	MUTE

Heat sink Fan Connector – 4-pin Hirose HR10A-7P-4S

Pin No	Function
1	+24V DC (Out)
2	N/C
3	0V (Out)
4	N/C

9 Control Protocols

The following section describes the control protocol employed on the RS232 link for controlling the SOLO transmitters and receiver equipment.

Connection details are detailed in previous sections.

Note that only features that are licensed for use in the SOLO units can be controlled. The protocols listed here cover all possible features. Attempting to activate an unlicensed feature will simply result in the command being ignored by the SOLO unit.

9.5 RS232 Control – General Principles

The physical interface is RS232 but this can be converted to RS 485 with an external adapter where multiple units are controlled over one RS 485 bus.

Normal operation involves sending a packet from the control device (normally a PC) to the device being controlled. If the packet satisfies an address integrity check, then the controlled device will action the command and send a reply.

For compatibility with modems an ASCII style protocol is used.

Ports are set for 8 bits, No parity, 1 stop

9.6 Packet Structure Sending (from PC)

ASCII	Value	
STX	02h	Start byte
0-9	30h-39h	4 byte unit address. In range 0-9999
R	20h-7Eh	1 byte command type. **r** read, **w** write or **m** misc
I	20h-7E	1 byte indicator of internal data block
ABC	20h-7Eh	Command –three byte mnemonic
;	3Bh	Separator
PQR	20h-7Eh	Data –Optional, variable length
;	3Bh	Separator
X	20h-7Eh	Sum Check
ETX	03h	End byte

9.7 Packet Structure Reply (from controlled device)

ASCII	Value	
STX	02h	Start byte
0-9	30h-39h	4 byte unit address. In range 0-9999
Z	20h-7Eh	Status BYTE
PQR	20h-7Eh	Data –Optional, variable length
;	3Bh	Separator
X	20h-7Eh	Sum Check
ETX	03h	End byte

The Sum check byte is the summation of all bytes in the packet, not including the start and end bytes. Higher order bytes are ignored and the final byte result is modified to prevent ASCII control characters being sent. Bit 7 (highest) is forced high.

Status byte will indicate command performed OK, or indicate an error.

ASCII	Meaning
1	All OK
E	General error, Command could not be actioned

Typically E will be returned if the message is formatted incorrectly (separators in wrong place) or if commands are in upper case, or if commands do not match against the allowed list of commands, or if the checksum is wrong.

Addresses in the range 0001 to 9998 are for general use. Address 0000 is reserved and 9999 is a broadcast address. i.e. any device will reply to this address. Its reply will contain its own specific address.

All data in the transmitter and receiver is stored as one of 5 data types, Double, String, List, Integer or HexInteger. The data type dictates the contents of the data section of the reply.

- List – 1 byte for sending. Value is hexadecimal coded as ASCII. 2 byte reply. Reply represents index into original choice list. e.g. Reply 02 indicates entry 2 in original list.
- Double - variable length. Reply always contains decimal point and 4 decimal places. Can have 1 to 3 digits before decimal.
- Integer - 6byte reply. integer value with stuffed with preceding zeros. e.g. GOP reply 000012 = GOP length 12
- String - Variable length. Reply is string excluding null terminator
- HexInteger – 8byte Hex reply

9.8 Transmitter Command List

Type ‘o’ messages for Modulation commands

Function	R/W	Block	Command	Data	Type
Set Modulation IF output	r/w	o	out	1 byte 0 OFF 1 COFDM	int
Set Narrow Band Modulation FEC	r/w	o	fec	1 byte 1 = 2/3 2 = 1/3	int
Set Narrow Band Modulation Guard Interval	r/w	o	gua	1 byte 1 = 1/16 2 = 1/8	int
Set Narrow Band COFDM mode	r/w	o	mod	1 byte 0 = QPSK 1 = 16 QAM	int
Set Modulation Freq	r/w	o	fre	Set Frequency in MHz, decimal point allowed.	double
Spectrum Inversion	r/w	o	spe	1 byte 0 = Normal 1 = Inverted	int
COFDM Bandwidth	r/w	o	wid	0 = 6MHz 1 = 7MHz 2 = 8MHz 3 = 2.5MHz 4 = 1.25MHz	list
Output level attenuation high	r/w	o	lev	Default level is 0 Value 0 to 32 1dB steps	int
Output High Low switch	r/w	o	hls	0 = low level 1 = high level (default)	int
Output level attenuation low	r/w	o	llv	Default level is 32 Value 0 to 32 0.25dB steps	int
DVB-T FEC	r/w	o	dfe	0 = ½, 1 = 2/3, 2 = 3/4, 3 = 5/6, 4 = 7/8	int
DVB-T Guard	r/w	o	dgu	0 = 1/32, 1 = 1/16, 2 = 1/8, 3 = 1/4	int
DVB-T mode	r/w	o	dmo	0 = QPSK, 1 = 16QAM, 2 = 64QAM	int
DVB-T 4K Offset	r/w	o	4ko	0 = none 1 = +4KHz 2 = -4KHz	Int
Range Mode Preset	r/w	o	txm	0 = none selected(default) 1 = short range 2 = medium range 3 = long range 4 = ultra long range	int

Type ‘z’ messages for Scrambling commands

Function	R/W	Block	Command	Data	Type
Scrambling	r/w	z	scr	1 byte 0 = Off 1 = ABS 4 = AES128 6 = AES256	int
AES Key lower 128	w	z	kez	Encryption key for AES lower 128	Hex string (32 characters)
AES Key	w	z	kex	Encryption key for	Hex string

upper 128 used in AES 256 only				AES upper 128	(32 characters)
ABS key	w	z	key	Encryption key for ABS	Hex string (12 characters)

Type ‘v’ and ‘e’ messages for Video commands

Function	R/W	Block	Command	Data	Type
Video Input	r/w	v	inp	1 byte 0 = Off 2 = PAL 3 = NTSC 4 = NTSC No Pedestal 5 = PAL S-vid 6 = NTSC S-vid 7 = NTSC S-Vid No pedestal 8 = SDI PAL 9 = SDI NTSC	int
Video Locked	r	v	loc	1 byte 0 = No 1 = Yes	int
Video Bitrate (Only applicable when chain in enabled)	r/w	e	vid	Value in Mbps	double
Video Horizontal resolution	r/w	e	hor	1 byte 0=704 1=528 2=480 3=352	int
Sleep if no video lock	r/w	v	sle	0 = normal 1 = sleep if no video	int
MPEG mode	r/w	e	enc	0 = MPEG2 1 = MPEG4	int
MPEG4 frame rate	r/w	e	frm	0 = full 1 = ½ 2 = ¼ 3 = 1/8 4 = 1/24	int
MPEG4 encoding option	r/w	e	cmd	0 = low delay interlaced (default) 1 = standard delay interlaced 2 = low delay progressive 3 = standard delay progressive	
MPEG4 video sharpness	r/w	e	sha	0 = normal (default) 1 = sharp	int
Manual Video Bitrate	r/w	e	vbr	Video bitrate manual over ride 0 = no override (default) Non-zero (sets the video bit-rate in kbps)	int

Type ‘a’ messages for Audio commands

Function	R/W	Block	Command	Data	Type
Audio Encoder Options 9,10,11 &12 are only supported in Software V3.3 +	r/w	a	enc	1 byte 0 = Off 1 = 32kHz,12cbit,S 2 = 32kHz,12cbit,M 3 = 32kHz,8cbit,S 4 = 32kHz,8cbit,M 5 = 16kHz,8cbit,S 6 = 16kHz,8cbit,M 7 = 8kHz,8cbit,S 8 = 8kHz,8cbit,M 9 = 32kHz MPEG L1 stereo 10 = 32kHz MPEG L1 mono 11 = 48kHz MPEG L1 stereo 12 = 48kHz MPEG L1 mono	int
Audio Input Level	r/w	a	lev	1byte 0 = 0dB (line level) 1= 12dB (mic level) 2 = 24dB(mic level) 3 = 36dB(mic level) 4 = 48dB(mic level) and 4 also enables ALC	int
MPEG Layer 1 Audio S/W V.3.3+	r/w	a	mpr	1byte 2 = 64kbit 3 = 96kbit 4 = 128kbit 5 = 160kbit 6 = 192kbit 7 = 224kbit 8 = 256kbit 9 = 288kbit 10 = 320kbit 11 = 352kbit 12 = 384kbit 13 = 416kbit 14 = 448kbit	int

Type ‘g’ messages for Unit Level commands

Function	R/W	Block	Command	Data	Type
Software Version	r	g	ver	Software version number	Hex string
FPGA Version	r	g	fpg	Fpga version number	Hex string
Serial Number	r	g	ser	Hex based serial number	Hex string
License Code	w	g	lic	License number for software facilities	Hex string
Narrow band Service Name	r/w	g	nam	Unit Name String	string
Set Unit address	r/w	g	add	Unit Address	int
Load Configuration Number	r/w	g	lod	Config Number	int
Restore Default Build	w	g	def	1 byte 0 = No 1 = Yes	int
Sleep Mode	r/w	g	sle	1 byte 0 =No 1 = Yes	int
Front Panel Lock	r/w	g	fpl	0 = unlocked 1 = locked	int
DVB-T Service name	r/w	g	dna	Unit Name String	string
Heart beat enable	r/w	g	blo	0 = off 1 = on	int
Initiate Code download S/W V3.3 +	w	g	dlc	65 to initiate full download 67 to initiate code only download	int

NOTE: inappropriate use of the ‘gdlc’ command will render the unit unusable

Type ‘d’ messages for Data commands

Function	R/W	Block	Command	Data	Type
Data On/Off	r/w	d	inp	1 byte 0 = Off 1 = On 2 = On (even parity) 3 = On (odd parity)	int
Input Data Baudrate	r/w	d	bau	1 byte 0 = 1200 baud 1 = 2400 baud 2 = 4800 baud 3 = 9600 baud 4 = 19200 baud 5 = 38400 baud 6 = 57600 baud (note 57600 is not supported in DVB-T modes) 7 = 115200 baud	int

Type ‘c’ messages for Chaining commands

Function	R/W	Block	Command	Data	Type
Chaining Input	r/w	c	inp	1 byte 0 = Off 1 = On 2 = Relay	int
Chaining Output	r/w	c	out	1 byte 0 = Off 1 = On	int
Chaining Loop	r/w	c	hio	1 byte 0 = Off 1 = output loop to input for external encryption	int
Chaining status – describes if chaining input is active	r	c	sta	1 byte 0 = Not Active 1 = Active 2 = Overflow	int
Chain Number	r/w	c	cha	0 - 9	int
Lowest Operating Frequency	r/w	c	flo	Frequency in MHz	double
Highest Operating Frequency	r/w	c	fhi	Frequency in MHz	double
Intermediate Operating Frequency 1	r/w	c	fl1	Frequency in MHz	double
Intermediate Operating Frequency 2	r/w	c	fl2	Frequency in MHz	double
Calibration point lowest	r/w	c	pl1	0 – 32 in 0.25dB steps	int
Calibration point intermediate 1	r/w	c	pl2	0 – 32 in 0.25dB steps	int
Calibration point intermediate 2	r/w	c	pl3	0 – 32 in 0.25dB steps	int
Calibration point highest	r/w	c	pl4	0 – 32 in 0.25dB steps	int
IQ Trim mode S/W V3.3+	r/w	c	itr	0- normal operation 1 – Set single/lower 2 - set mid point 3 – set upper point	int
I trim Value S/W V3.3+	r/w	c	iqi	-128 to +127 Signed but set and read as unsigned (255 = -1)	int
Q Trim Value S/W V3.3 +	r/w	c	iqq	-128 to +127 Signed but set and read as unsigned	int

9.9 Receiver Command List

Type '1' messages for Tuner / Demod

Description	Type	Block	Command	Data Sent	Data Type
Input Frequency	r/w	1	ipf	This is the frequency received by the antenna. Decimal point allowed.	Double
Down Converter LO	r/w	1	dco	Decimal point allowed.	Double
Down Converter LO Side	r/w	1	los	0=low 1=high	List
OFDM Bandwidth	r/w	1	wid	N.Band Mode 3 = 2.5MHz 4 = 1.25MHz DVBT Mode 0 = 8MHz 1 = 7MHz 2 = 6MHz	List
OFDM Modulation Mode	r	1	mod	N.Band Mode 0 = QPSK 1 = 16QAM DVBT Mode 0 = QPSK 1 = 16QAM 2 = 64QAM	List
OFDM FEC	r	1	fec	N.Band Mode 1 = 2/3 2 = 1/3 DVBT Mode 0 = 1/2 1 = 2/3 2 = 3/4 3 = 5/6 4 = 7/8	List
OFDM Guard	N.Band Mode r/w DVBT Mode r	1	gua	N.Band Mode 1 = 1/16 2 = 1/8 DVBT Mode 0 = 1/32 1 = 1/16 2 = 1/8 3 = 1/4	List
OFDM Pol	r	1	pol	0 = Normal 1 = Inverted	List
Input SNR A	r	1	snr	Input SNR in dB	Double
Input SNR B	r	1	mer	Input SNR in dB	Double
Input SNR C	r	1	cer	Input SNR in dB	Double
Input SNR D	r	1	dnr	Input SNR in dB	Double
BER Pre Viterbi	r	1	pre	Pre Viterbi x 10-6	Int
BER Post Viterbi	r	1	pos	Post Viterbi x 10-6	Int
Packet errors	r	1	pkt		Int
Lock Status	r	1	loc	0 = Not Locked 1 = Locked	List
Input Level A	r	1	ina	Input Level in dBm	Double
Input Level B	r	1	inb	Input Level in dBm	Double
Input Level C	r	1	Inc	Input Level in dBm	Double
Input Level D	r	1	ind	Input Level in dBm	Double

Type ‘g’ messages for Unit level commands

Description	Type	Block	Command	Data Sent	Data Type
Unit Mode	r/w	g	udm	0 = Narrow Band 1 = DVBT	List
Input Mode	r/w	g	mod	0 = RF Input 8 = Chaining Input	List
LNB Power	r/w	g	lnb	0 = OFF 1 = ON	List
Unit RS232 Address	r/w	g	add	Unit Address 0000 - 9999	Integer
Software Version	r	g	sof	Software Version Number	String
FPGA Version	r	g	fpg	FPGA Version Number	String
Serial Number	r	g	ser	Hex based Serial Number	String
License Code	w	g	lco	License number to enable certain features	List
On Screen Display	r/w	g	osd	0 = Off 1 = Channel A 2 = Channel B 3 = Channel C 4 = Channel D	List
Auxiliary Address (used in daisy chaining mode)	r/w	g	aux	Unit Address 0000 - 9999	Integer
AGC Meter Scale	r/w	g	agc	Range 0 - 10.0 Decimal point allowed.	Double
Daisy Chain RS232 Control	r/w	g	cdc	0 = OFF 1 = ON	List
Auto Spectrum Detection (Narrow Band)	r/w	g	asd	0 = OFF 1 = ON	List
Chaining Output Mode 1	r/w	g	cha	0 = Demod 1 = Chaning In	List
Chaining Output Mode 2	r/w	g	ch2	0 = Pre-Descrambling 1 = Post-Descrambling	List
License Mask	r	g	lma	Bit mask of licensed features	Integer
Down Converter Gain Offset	r/w	g	dcg	Range -30.0 - +30.0. Decimal point allowed.	Double
Board Type	r	g	bty	PCB Type	String

Type ‘e’ messages for Decoder configuration commands

Description	Type	Block	Command	Data Sent	Data Type
Unit Number	r/w	e	ser	Index into List of programs	List
Preferred Unit Name	r/w	e	def	Preferred Unit Name	String
525 Video Format	r/w	e	525	0 = YUV 1 = NTSC 2 = NTSC No Ped	List
625 Video Format	r/w	e	625	0=YUV 1 = PAL	List
Locked	r	e	loc	0 = No 1 = Yes	List
Line Standard	r	e	lin	0 = 625 1 = 525	Integer
Fail mode	r/w	e	fai	0 = freeze 1 = blue	List
Power Up Line Standard	r/w	e	pwr	0 = 625 1 = 525	List
Service Scrambling Status	r	e	scr	0 = Clear 1 =Scrambled	List
MPEG-4 De-blocking Filter	r/w	e	deb	0 = Enable 1 = Disable	List
Received Video Type	r	e	vid	0 = MPEG-2 1 = MPEG-4	List
Transmitter Video Input Lock	r	e	txv	0 = Unlocked 1 = Locked	List
Default Service Name Match	r	e	dsm	0 = No match 1 = Match	List
Video PID	r	e	vpi	13-bit PID	Integer
Audio PID	r	e	api	13-bit PID	Integer
Data PID	r	e	dpi	13-bit PID	Integer

Type ‘d’ messages for Memory configuration commands

Description	Type	Block	Command	Data Sent	Data Type
Store Current Configuration to Memory	r/w	d	sto	Config Address (1 to 9)	Integer
Load Configuration from Memory into current	r/w	d	loa	Config Address (1 to 9)	Integer
Restore Default Build	r/w	d	def	0 = No 1 = Yes	List
Read number of last config loaded	r	d	las	Config Address	Integer

Type ‘z’ messages for Descrambling commands

Description	Type	Block	Command	Data Sent	Data Type
Descrambling	r/w	z	des	0 = Off 1 = ABS 4 = AES128 5 = AES128+ 6 = AES256 7= AES256+	List
ABS Scrambling Key	w	z	ebs	Alink basic scrambling key	8-digit hex string
AES Scrambling Key – lower 128 bits	w	z	aes	Advanced Encryption Standard – lower 128 bits	32-digit hex string
AES Scrambling Key – upper 128 bits used in AES256 only	w	z	a25	Advanced Encryption Standard – upper 128 bits	32-digit hex string

Type ‘t’ messages for RS232 data pipe commands

Description	Type	Block	Command	Data Sent	Data Type
Data On/Off	r/w	t	dat	0 = Off 1 = On	List
Data Baudrate	r	t	bau	2 = 1200 baud 3 = 2400 baud 4 = 4800 baud 5 = 9600 baud 6 = 19200 baud 7 = 38400 baud 8 = 57600 baud 9 = 115200 baud	List
Data Parity	r/w	t	par	0 = none 1 = even 2 = odd	List

10 Default Configurations

This section tabulates the default configuration settings for domo robust SOLO4 products.

Item	11204-01-23 **TX Config 1 to 8**	11204-01-13 **TX config 1 to 8**	11204-01-03 **TX config 1 to 8**
RF Output	OFF	OFF	OFF
Frequency	3200MHz	2405MHZ	1395MHZ
Modulation	QPSK	QPSK	QPSK
Power	Maximum	Maximum	Maximum
Standby	OFF	OFF	OFF
Unit Address	0001	0001	0001
Unit name	Solo-01 (SOLO4)	Solo-01 (SOLO4)	Solo-01 (SOLO4)
Horizontal Resolution	528	528	528
Video Input	PAL	PAL	PAL
Audio	OFF	OFF	OFF
Data	OFF	OFF	OFF
Audio Input	Line level	Line level	Line level
Scrambling	OFF	OFF	OFF
AES Key	None	None	None

Item	**11302-01-23** **RX Configs 1 to 8**	**11302-01-13** **RX Configs 1 to 8**	**11302-01-03** **RX Configs 1 to 8**
LNB Power	ON	ON	ON
Frequency	3200MHz	2405MHz	1395MHZ
Down converter LO	1880	1880	1700
LO Side	Low	Low	High
Unit Address	0001	0001	0001
Default Service	Solo-01 (SOLO4)	Solo-01 (SOLO4)	Solo-01 (SOLO4)
Video Fail	Blue Field	Blue Field	Blue Field
Data	ON	ON	ON
De-Scrambling	OFF	OFF	OFF
AES Key	None	None	None

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